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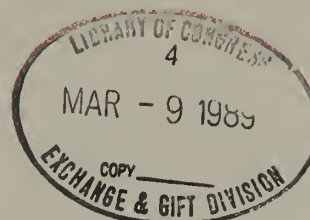




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# Characterization of the 1986 Sand and Gravel Mining Workforce

By Shail J. Butani and Ann M. Bartholomew



UNITED STATES DEPARTMENT OF THE INTERIOR



*(United States Bureau of Mines)*  
Information Circular 9203

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**By Shail J. Butani and Ann M. Bartholomew**

**UNITED STATES DEPARTMENT OF THE INTERIOR  
Donald Paul Hodel, Secretary**

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## UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

h	hour	pct	percent
yr	year		

# CHARACTERIZATION OF THE 1986 SAND AND GRAVEL MINING WORKFORCE

By Shail J. Butani<sup>1</sup> and Ann M. Bartholomew<sup>2</sup>

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## ABSTRACT

In 1986 the Bureau of Mines conducted a probability sample survey, Mining Industry Population Survey, to measure such employee characteristics as occupation; principal equipment operated; work location at the mine; present job, present company, and total mining experience; job-related training during the last 2 years; age; sex; race; and education. The population estimates are necessary to properly analyze the Mine Safety and Health Administration (MSHA) injury (includes illness and fatality data) statistics; that is, to compare and contrast injury rates for various subpopulations in order to identify those groups that are exhibiting higher than average injury rates.

This report uses the survey's results to characterize the U.S. sand and gravel mining workforce from March through September 1986. Similar reports have been prepared for the metallic, stone, and nonmetallic mining industries, as well as for the entire metal and nonmetal mining (includes metallic, stone, sand and gravel, and nonmetallic industries) sector and the coal mining sector.

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## INTRODUCTION

According to the occupational safety and health (OSH) statistics published annually by the U.S. Department of Labor, Bureau of Labor Statistics, the mining industry (excluding oil and gas extraction) always has had one of the highest injury incidence rates among the major industry divisions. One of the primary objectives of the Bureau of Mines is to conduct research in the area of health and safety of the nation's miners, aimed at reducing the incidence rate of work-related injuries (includes illnesses and fatalities) in the domestic mining industry. In order to reduce the overall incidence rate, the Bureau needs to identify which groups or subpopulations of the workforce are exhibiting higher than average incidence rates.

To identify the high-risk groups, information about the injured workers and about the entire workforce is required. Present regulations permit MSHA to collect information on all mine injuries requiring medical attention. Hence, a data base containing various characteristics on the *injured* workforce is available. Since similar information about the *entire* workforce was not available, the Bureau conducted a probability sample survey called the Mining Industry Population Survey (MIPS), also known as the demographics survey, to collect the necessary data. The 1986 survey measured the following characteristics: job title or occupation, principal equipment operated, work location at mine, experience at present job, experience at present company, total mining experience, job-related training during the last 2 years, age, sex, race, and education. This demographics survey provided information about the population at risk and will aid research in pinpointing the hazardous segments of the population, as illustrated by the following example.

From MSHA's injury data base, it is known that 1,399 males and 11 females working in the U.S. sand and gravel mining industry were injured in 1986. If information about the population at risk (i.e., the number of male and female workers for the sand and gravel mining industry in 1986) is not known, then it is not valid to draw the conclusion that male miners are at a much higher injury risk than female miners. The estimates from the demographics survey show that there were a total of 34,088 male workers and 2,814 female workers (table E-15) employed in U.S. sand and gravel mining in 1986. Of these workers, the nonoffice workforce iden-

tified by occupation or job title consists of 32,949 males and 790 females (table E-7). The reason for excluding office workers from the analysis is to account for some of the obvious difference in job risk. It should be noted that in the office worker category only 3 pct are males and 72 pct are females (table E-15). The added information on the population puts the injury statistics in a better perspective, as shown in table 1.

**Table 1.—Population and injury statistics for 1986 sand and gravel mining sector**

	Population statistics		Injury statistics			
	Workers	pct	Injuries	pct	Lost workdays	pct
Male . . . .	32,949	97.7	1,399	99.2	20,594	99.3
Female . . .	790	2.3	11	.8	151	.7
Total . . .	33,739	100.0	1,410	100.0	20,745	100.0

Since the difference between the distribution of workers and injuries, as well as lost workdays, is relatively large, it would be interesting to further investigate the source of variation. Could the source be job mix by sex?

Hence, the present research will aid in finding solutions to reduce the injury incidence rates for the high-risk groups. That is, the collected information will be used to compare and contrast the demographics composition of the hazardous groups with those of the safer groups. Thus, through present research, the differences and similarities between the two groups can be defined.

The purpose of this report is to provide the U.S. sand and gravel mining population estimates for March through September 1986 by various characteristics. This information is essential to performing the injury data analysis that is the ultimate goal of the survey.

In addition to this report, there are three companion reports (1-3)<sup>3</sup> covering the metallic, stone, and nonmetallic mining industries. Summary reports have been published for the entire metal and nonmetal mining industry (4) and the coal mining industry (5).

## ACKNOWLEDGMENTS

The authors thank the officials of the U.S. Department of Labor, MSHA, for submitting the MIPS justification package to the Office of Management and Budget for its clearance to collect the data. Special thanks go to Kathy Snyder, public affairs specialist, Office

of Information and Public Affairs, MSHA, for initiating the study, and to Edwin Thomasson, research liaison officer, Technical Support, MSHA, for his continuous effort and support.

## SURVEY METHODOLOGY

### POPULATION

The MIPS covered all workers employed in the anthracite coal (SIC<sup>4</sup> 111), bituminous coal (SIC 121), metal (SIC 101-106, 109, 281), stone (SIC 141, 142, 324, 327), sand and gravel (SIC 144), and nonmetal (SIC 131, 145, 147, 149, 289, 299) mining industries of the United States during the period March through September 1986. This report gives estimates only for the sand and gravel mining sector.

The information pertaining to the mine employees included in the survey was collected through the mine operators, because a comprehensive sampling frame (name and address file) of the workers

in mine establishments was not available, and cost considerations prohibited the data collection through personal visits. The number of universe units (establishments under MSHA's jurisdiction) covered by the scope of this survey was approximately 18,350, with a total employment level of about 350,000. The number of establishments and employment for the sand and gravel mining was about 5,580 and 40,000, respectively. The scope of the data for

<sup>3</sup>Italic numbers in parentheses refer to items in the list of references preceding the appendixes at the end of this report.

<sup>4</sup>The Standard Industrial Classification (SIC) was revised in 1987; the industry group numbers used here are those in effect at the time of the MIPS.

the employees covered by this survey is the same as that of the data collected by MSHA form 7000-1 for mine accidents, injuries, illnesses, and fatalities, and MSHA form 7000-2 for quarterly mine employment. The collection of the fundamental statistics reported on these two forms is required by law (30 U.S.C. 813; 30 CFR 50).

## SAMPLE

The principal feature of the survey sample design was its use of two-stage stratified random sampling. The primary sampling units (first stage) were the mine establishments; the secondary sampling units were employees within each of the chosen mine establishments. The characteristics used to stratify the primary units were the industry (anthracite coal, bituminous coal, metal, stone, sand and gravel, nonmetal); mine type (underground, surface, plant or mill); employment size class (1-19, 20-49, 50-99, 100-249, 250-499, 500-999, 1,000 and above); and status code (active, intermittent). Since the first three stratification characteristics are highly correlated with the characteristics that the survey was to measure, use of stratified sampling increased the efficiency of the sample design and thus resulted in a smaller required sample size. The fourth characteristic, status code, was chosen so that nonresponse adjustment could be made within more homogenous groups. This is desirable because proportionately higher numbers of nonmailable, out-of-business, refusal, etc., responses are reported from intermittent mine establishments than from active mine establishments.

The sampling frame used for this survey was the 1985 preliminary address and employment file maintained by MSHA. A probability sample of 863 sand and gravel mining establishments from a universe of 5,579 sand and gravel mining establishments was selected by stratifying the frame as previously described and using a systematic sampling procedure with a random start for each stratum. The employees within an establishment were selected by using a systematic sampling procedure with a common random start for each employment size class.

A brief description of the sample allocation is as follows. For larger employment size classes, the allocation procedure placed all of the establishments on the frame in the sample as primary sampling units from which the employees were subsampled at a low frequency rate. As employment size class decreased, smaller and smaller proportions of the establishments were included as primary sampling units, but the employees within the establishments were subsampled at a higher frequency rate. The use of this procedure gave each employee, to the extent possible, about the same probability of inclusion in the sample, thus reducing the sampling variability. In order to limit the response burden for any one establishment, a maximum sample of 50 employees per establishment was selected.

## DATA COLLECTION

The MIPS was conducted from March through September 1986 by mail questionnaire through the Bureau's Twin Cities (MN) Research Center. A reproduction of the original letter, followup letter, and the questionnaire bearing the Office of Management and Budget clearance number authorizing collection of the data are included in appendix F.

The response status for the sand and gravel mining sector from the original and followup mailings, as well as from telephone calls to the nonrespondents, is summarized here. From a total population of 5,579 sand and gravel mining establishments, the survey sampled 863 operations. The *overall response and rate* were 810 and 94 pct, respectively. There were 129 out-of-scope returns (i.e., out of businesses, nonmailables, duplicates, temporary inactives, and new businesses under construction); the remaining 734 returns

were within the scope of the survey (i.e., nonrespondents, usables, refusals, and unusables). Of the 734 in-scope records, 646 were usables. Thus, the survey achieved a *usable response rate* of 88 pct.

A brief description of the response terms follows:

<i>Response code</i>	<i>Description</i>
Nonrespondent . . . . .	Received no response from the establishment.
Usable . . . . .	Establishment provided usable data.
Refusal . . . . .	Establishment refused to provide any data.
Unusable . . . . .	Establishment provided data that were not in usable format.
Nonmailable . . . . .	Establishment's address was either insufficient or wrong.
Duplicate . . . . .	Data were combined with another establishment's data.
Out-of-business . . . . .	Establishment was permanently closed.
New business . . . . .	Establishment was in development stage.
Temporary inactive . . . . .	Establishment was temporarily not operating.

As part of the data collection phase, all the returns were reviewed and edited for completeness and reasonableness of the data. Whenever there were inconsistencies, the respondents were called for reconciliation. Also, almost all of the respondents that had initially refused to participate in the survey were contacted by phone. Approximately 80 pct of these respondents ultimately supplied data. Adjustments for those mine establishments that did not supply the data, or supplied partial data, are explained in the "Estimation Procedures" section and in appendix C.

## DATA CODING, ENTERING, AND EDITING

The returns underwent a very comprehensive review and editing process in order to (1) minimize the reporting differences among the respondents (establishments), (2) ensure consistency of coding among the individual worker entries, (3) ensure the accuracy of the data entry, and (4) ensure compatibility of occupation and equipment coding with the MSHA injury data base.

## ESTIMATION PROCEDURES

In a simple random sampling plan, all units are sampled with the same sampling ratio. To derive the population estimates, the sample units are weighted (replicated) by the inverse of the sampling ratio. Because of efficiency consideration, the data for this demographics study were collected using a complex survey design. Hence, the data for each worker, the ultimate sampling unit, were not equally weighted. Instead, the population estimates were derived by weighting data for each worker with the appropriate final weight which of the data, was the product of the following three factors: (1) the inverse of the sampling ratio with which the primary sampling unit (establishment) was sampled; (2) a nonresponse adjustment factor that was computed separately for each sampling stratum and assigned to all responding establishments in a stratum to account for those establishments in that stratum that did not respond; and (3) the inverse of the sampling ratio with which the secondary sampling units (workers) were selected. A detailed discussion of the different weights and estimation formulas are given in



appendix C. In statistical terms, the survey's estimates of the population total were based on a Horvitz-Thompson estimator (6).

No adjustment was made for partial nonresponse. That is, the characteristics that were left blank by the respondents were coded as unspecified and were, naturally, weighted by their appropriate final weight in computing the population estimates. The percentage unspecified for a particular characteristic gives the user an indication of the completeness of the schedules.

## GROUPING OF CHARACTERISTICS

The original data base has detailed data for the characteristics mentioned below. For purposes of publication, the detailed data were combined into groups. Please contact the authors to obtain detailed data or a different grouping of the data for any or all of the characteristics.

### Job Title and Principal Equipment Operated

Since the original data base has about 100 codes for each of these two categories (see appendixes A and B), the entries were combined into 20 to 25 groups. Similarities of the job title or principal equipment operated and number of workers in each entry were two of the main criteria used in forming the groups.

### Employment Size Class

The classes used for this characteristic are the standard size class definition used by MSHA. Because there were very few mines for the size class having 100 through 249 employees, the estimates for this class were computed separately and then were combined with the estimates for employment size class 50 through 99 in order to protect the confidentiality of the mines as well as the workers. The combined size class is labeled as 50 through 249.

### Present Job, Present Company, and Total Mining Experience

The data for all three of these characteristics were coded only as the number of years. It was felt that data were not reliable enough to be accurate to the month. The groupings were formed to be as compatible as possible to the groupings used by MSHA for its injury statistics.

### Job-Related Training During Last 2 Years

The grouping for this characteristic was formed to reflect the definite and logical intervals that various mine operators employ and that meets the need of the mine safety personnel. The most frequently reported number was 16 h for training during the last 2 years; this is because MSHA requires a minimum training of 8 h/yr. Also, MSHA and safety personnel are interested in knowing the percent of workers who receive no training. Hence, both 0 and 16 h were categorized separately.

### Age

The groupings for age were formed to be about the same as what MSHA uses for its injury statistics.

## RELIABILITY OF ESTIMATES

As stated in reference 7:

All estimates derived from a sample survey are subject to sampling and nonsampling errors. Sampling errors occur because observations are made on a sample, not on the entire population. Estimates based on the different possible samples of the same size and sample design could differ. Nonsampling errors in the estimates can be attributed to many sources, e.g., inability to obtain information about all cases in the sample, mistakes in recording or coding the data, definitional difficulties, etc.

Nonsampling errors occur in a census as well as in a sample survey. As mentioned earlier, the completed forms underwent a very comprehensive review and edit process. This was primarily done to minimize the nonsampling errors.

In a probability sample, the coefficients of variation (CV's), which are a measure of the sampling errors in the estimates, can be estimated from the survey data. CV's were calculated for the basic characteristics as part of the survey estimation process; these CV's as well as the corresponding estimates for number of workers are given in tables E-41 through E-48. The CV's for other estimates can also be derived if requested. The methodology used to compute the estimated CV's is given below.

By definition, the CV of any sample estimate is equal to the standard error of the estimate divided by the value of the estimate (8). In other words, it is a measure of relative variation. Because the survey data will be used by numerous researchers to measure different statistics (e.g., totals, means, medians, percentages) by various cross-classification categories, it was not feasible to use the exact formula for the standard error estimates. Hence, a generalized formula that approximated the exact formula and that was easy to implement for computing all the standard error estimates was developed. It should be noted that since the survey uses a complex sampling design, the usual variance, standard deviation, and standard error estimates computed by the software packages are no longer valid because they are based on simple random sample design. The reliability measures for this survey were computed by employing a random group variance technique. A brief description of it is given in appendix D and a detailed discussion is given in reference 9.

The purpose of producing a reliability measure for this report is to define the confidence interval or range that would include the comparable complete coverage value. For example, the total number of estimated truck drivers for the 1986 sand and gravel mining industry was 8,274 (table E-1 and E-42) with a CV of 9.5 pct (table E-42). Based on this information, the standard error on the total number of truck drivers is 786 (estimate  $\times$  CV =  $8,274 \times 0.095$ ) and the 95-pct confidence interval is 6,702 to 9,846 ( $8,274 \pm 2 \times 786$ ). This means that with 95 pct confidence, it can be said that the interval 6,702 to 9,846 includes the total number of truck drivers in the sand and gravel mining industry that would have been obtained from a census of the frame.

In general, the smaller the subpopulation size, the larger the variability in the estimates. Additionally, the larger the nonresponse, the less reliable the estimate may be. As mentioned earlier, nonresponse error is considered a nonsampling error. This error occurred more frequently for estimates of job-related training during the last 2 years and total mine experience than for other variables because conceptually these variables are harder to report. Moreover, it is possible that the training estimates might be somewhat biased because many respondents filled in 16 h, the minimum number of hours required by MSHA over a 2-year period.



## VALIDATION OF ESTIMATES

Once the estimates were produced, they were validated for accuracy and reasonableness by several mining industry specialists. Additionally, the total employment for each industry was compared to an independent census conducted by MSHA, the results of which are reported in references 10 through 14. The injury experience reports tabulate the injury-illness-fatality data reported to MSHA on form 7000-1 and employment data reported on form 7000-2. While the data base used to compile the statistics for these reports contains detailed information for the injured victims, it does not contain similar information for the entire workforce. The breakdown of total employment is available only by type of ore mined, employment size class, and work location. Hence, the MIPS was conducted so that MSHA injury data could be analyzed in greater detail.

The data show that the overall employment figures from the two sources differed about 9 pct for the sand and gravel mining industry, with the MSHA figures being higher than those of the demographic survey. The difference in the estimates is caused in part by differences in reporting, coverage period, definitions, and methodology as explained below for data comparison by employment size class and by work location.

When comparing distribution of workers by employment size class, the differences between the data of the total row of table E-1 of this report and MSHA data as stated in table 3 of reference 12 are substantial. This is mainly due to the differences in definition and methodology. The MIPS classification is based on total employment of an establishment as it existed when the respondents filled out the questionnaire. MSHA collects employment on a quarterly basis, and for each quarter it is possible for the employment to be broken into a maximum of four different work locations; hence, each establishment may have up to 16 different employment figures.

Per MSHA's methodology, the size groups are classified according to the lowest numbered (primary) subunit's average

employment of four quarters and *not on the total employment* of an establishment, as is the case with the MIPS. For example, if an establishment's annual average employment is 60, but the employment for the primary subunit, say underground, is 15, then the establishment per MSHA's methodology is classified in size class 1 through 19, whereas according to the MIPS procedure it is in size class 50 through 99. It should be noted that MSHA classification overestimates the employment in smaller size classes.

In view of the above, the injury data as published in reference 12 by size class should not be analyzed against the MIPS employment size class data. Instead, the analyst needs to retabulate the MSHA injury data from the original data tapes so that the size class definition corresponds to the MIPS.

Also, a large difference existed between MIPS and MSHA figures for employment distribution by work location. This is primarily due to differences in reporting. The employment reported to MSHA every quarter is in aggregate numbers for each work location (maximum of four). Generally, this type of reporting results in gross approximations in the breakdown of variables such as employment. For the MIPS data, the work location was reported for each worker in the sample, in the same manner as it is reported to MSHA on form 7000-1 for each injured worker. It should be noted that the data on work location for individual workers is known with more specificity than for the whole population. Hence, it is appropriate to analyze the survey work location data with MSHA injury statistics.

Additionally, a small portion of the difference in the two estimates is due to the job title category of office workers. The MIPS underestimated the number of employees in this category because many respondents assumed that these workers very seldom incur injuries and therefore were not to be reported. For the purposes of injury analysis, the office workers are to be excluded because of some of the obvious difference in the injury risk. Hence, the difference in counts of office workers does not make any difference.

## SUMMARY OF MAJOR FINDINGS

The findings of the survey by various cross-classifications are given as estimates in tables E-1 through E-40 appendix E); tables E-41 through E-48 give reliability estimates for the basic characteristics and a detailed discussion of their use is given in the "Reliability of Estimates" section. If desired, the estimates by some other classification criteria including more detailed estimates (e.g., distribution of workers by age and experience at present company working at the plant or mill location) can be derived from the original data base. The following findings are based on the data for the entire 1986 sand and gravel mining workforce.

- The total estimated workforce for 1986 was approximately 37,100 (table E-1). The data in table E-1 also indicate that 68 pct of the workforce was employed in establishments with 19 or less employees, 25 pct in establishments with 20-49 employees, and 7 pct in establishments with 50-249 employees. This indicates that the bulk of the employment was in establishments having 19 employees or less.
- Truck driver was the largest category of workers with 22 pct employment, followed by front-end loader-forklift operator with 16 pct, and plant operator-warehouseman with 11 pct (table E-1). Each of the remaining occupation groupings had fewer than 10 pct of the employees.
- The distribution of workers by work location was surface mine, 72 pct; plant or mill, 16 pct; and office 12 pct (table E-3).

- The job title category manager-foreman-supervisor had the highest median experience at job (table E-10), at company (table E-11), as well as at mining (table E-12). It should be noted that in this context three types (general, maintenance, and working) of manager-foreman-supervisor were combined because maintenance and working foreman categories were too small.
- Mean hours of training during the last 2 years was lowest (26 h) for the truck driver category (table E-13).
- Of the female employees, 72 pct had the job title category office worker, compared with 3 pct of the males (table E-15).

The following findings are based on sand and gravel mining data that exclude the job title category of office worker.

- The largest category of equipment operated was haulage truck with 25 pct of the employment, followed by front-end loader-forklift with 20 pct, plant equipment with 15 pct, and none with 10 pct (table E-2).
- The median experience at present job, present company, and total mining were 4, 5, and 8 years, respectively (table E-4).
- Job-related training during the last 2 years was unspecified for 35 pct of the workers (table E-5). Of the specified population, mean hours of training were 38, 27, and 39 for size classes 1-19, 20-49, and 50-249, respectively, and 35 h for all three size classes combined.

- Mean age was about 39 years across all size classes (table E-6). The age group 50 and over had the largest number of workers (7,821), followed closely by the 40-49 age group (6,583). Combined, these two groups made up about 42 pct of the workforce.
- Males made up 98 pct of the workforce (table E-7). Note that the 98-pct figure excludes the unspecified category.
- Whites, blacks, and Hispanics made up 84, 5, and 7 pct, respectively, of the workforce (table E-7). The remaining 3 pct workers belonged either to another race or were unspecified.
- Of those workers whose education was specified, 70 pct had a high school or better education (table E-7). Note that this figure is obtained by (1) summing the workers in the categories high school diploma, vocational diploma, some college, and college degree, and (2) dividing this sum by the total number of workers minus the workers in the unspecified category. In this case, it is 21,054 divided by 29,897.
- The distribution of workers by principal equipment operated also varied considerably between males and females (table E-21); this was especially true for the categories front-end loader-forklift, plant equipment, scale-lab equipment-controls, haulage truck, and none. For example, 26 pct of the males operated haulage trucks, compared with only 8 pct of the women.

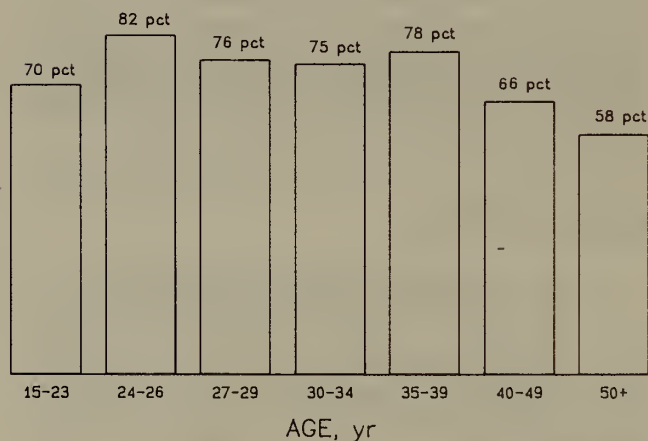


Figure 1.—Percentage of 1986 sand and gravel mining workforce with at least a high school diploma, by age (excluding job title category of office worker, as well as workers whose education was unspecified).

- There was a higher percentage of employees with at least a high school education under the age of 40 than there were of age 40 and over (table E-38 and figure 1); proportionately more females had a high school or higher education than males (table E-39 and figure 2); education by race (table E-40) is shown in figure 3.

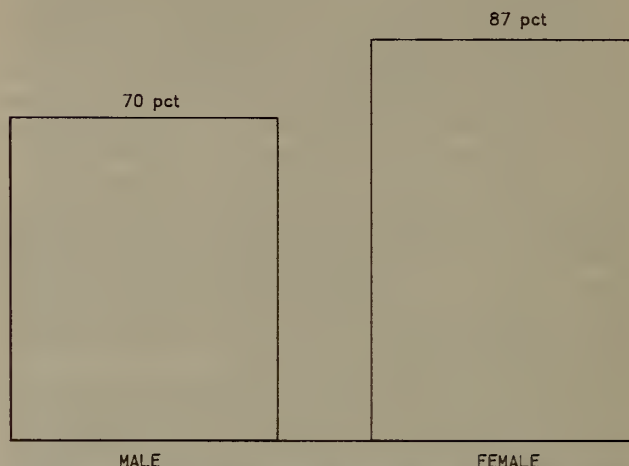


Figure 2.—Percentage of 1986 sand and gravel mining workforce with at least a high school diploma, by sex (excluding job title category of office worker, as well as workers whose education was unspecified).

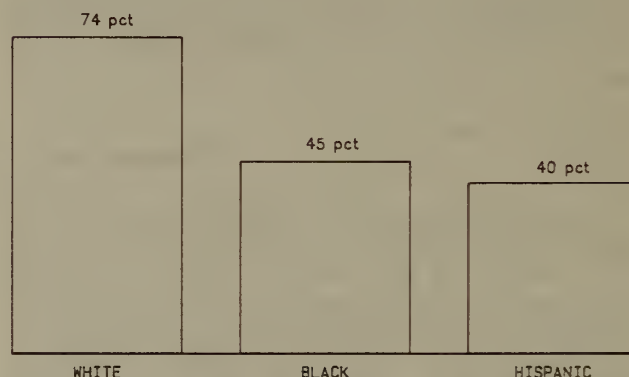


Figure 3.—Percentage of 1986 sand and gravel mining workforce with at least a high school diploma, by race (excluding job title category of office worker, as well as workers whose education was unspecified).

## APPLICATION OF DATA FOR INJURY ANALYSES

The ultimate objective of this study is to provide a basis for—

1. Analyzing the 1986 MSHA sand and gravel mining injury statistics and identifying those subpopulations exhibiting higher or lower than average injury rates.

2. Producing some selected estimates by geographic location such as regions (east, central, west), MSHA districts, or States, and performing injury data analyses.

3. Developing an easy to use computerized data base that would be available to the researchers to do their own analyses especially in the area of targeting injury prevention and training efforts.

The results from these analyses, which encompass all facets of mining operations, can help identify areas where research efforts should be devoted to achieve the greatest safety improvements, thus preventing creation of unnecessary regulations or crash research programs that tend to waste funds.

## RECOMMENDATIONS FOR FUTURE WORK

1. After the injury analyses are performed, and the hazardous areas or subpopulations have been identified, it would be desirable to further investigate their problems and needs. This can be accomplished by conducting some special surveys such as an equipment use survey, maintenance related work survey, small mines survey, etc.

2. Repeat the MIPS and perform the injury analyses periodically, say every 3 to 5 years, in order to study the changing mining

environment and its impact on mining safety and productivity. When the survey is repeated, it is recommended that modifications be made to the questionnaire to reflect new needs. It is also recommended that the collection of total mine experience and job-related training data be eliminated, since these variables are conceptually very hard to measure. Also, the variables experience on the job and experience with the company should be measured in years only.

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## APPENDIX A.—SAND AND GRAVEL MINING INDUSTRY JOB TITLE GROUPING

<i>Description</i>	<i>Job title code</i>
Backhoe-crane-dragline-shovel operator .....	367, 378, 778, 387
Beltman-belt repairman .....	601, 1012, 996
Blaster .....	807
Deckhand-barge and dredge operator .....	372
Dozer-heavy and mobile equipment operator .....	368, 768, 985
Driller-rock bolter .....	33, 34, 333, 334, 1056, 46
Electrician-lampman .....	402, 602, 603, 385
Front-end loader-forklift operator .....	382, 782, 825, 389
Grader-scraper operator .....	375, 775, 957
Laborer-miner-utility man .....	616, 53, 316, 36, 38, 39, 45, 57, 58, 59, 158, 216, 224, 327, 386, 395, 609, 624, 663, 710, 716, 874, 997, 1013, 1055
Manager-foreman-supervisor:	
General .....	430, 449, 481, 489, 494
Maintenance .....	418
Working .....	749
Mechanic-welder-oiler-machinist .....	404, 604, 605, 1019, 1018, 1060, 394, 608
Mine technical support .....	320, 393, 396, 414, 423, 456, 464, 495, 593, 594, 920, 921, 930, 965, 998, 1014
Office worker .....	497
Plant operator-warehouseman .....	374, 379, 380, 388, 390, 392, 1022
Shuttle car-tram operator .....	850, 28, 29, 269, 373, 728, 962, 969
Truck driver .....	376, 776

<i>Code</i>	<i>Description</i>	<i>Code</i>	<i>Description</i>
28.....	Scoop tram operator	269.....	Chute puller, underground
29.....	Mucking machine operator		Locomotive operator
33.....	Driller helper, underground		Car loader underground
34.....	Exploration driller, underground		Whistle punk, underground
	Longhole driller, underground	316.....	Service truck operator
	Prospect driller, underground		Laborer
	Diamond driller, underground		Track gang, surface
36.....	Continuous miner operator		Surface worker
38.....	Cutting machine operator		Utility man, surface
39.....	Hand loader		Pumper, surface
	Trammer		Tamping machine operator
45.....	Hangup man	320.....	Cage attendant, surface
	Rockman		Aerial tram—outside only
	Raise blaster	327.....	Surface miner
	Chute blaster	333.....	Driller helper
	Rock handler	334.....	Carriage-mounted drill operator, surface
46.....	Pinner		Wagon drill operator, surface
	Truss bolter		Churn driller, surface
	Rock bolter		Rotary drill operator
	Roof trimmer		JP drill operator, surface
	Roof man		Air-track driller, outside only
	Scaler operator	367.....	Backhoe operator
	Roof bolter		Power shovel operator
53.....	Nipper		Pitman
	Utility man	368.....	Dozer operator
57.....	Stope miner		Track operator helper, surface
58.....	DXC miner		Tractor operator, surface
	Drift miner	372.....	Deckhand
59.....	Raise miner		Dredge operator
158.....	Rock machine operator, underground		Barge attendant
216.....	Trackman		Barge loader
224.....	Trainees, underground		Boat operator

<i>Code</i>	<i>Description</i>	<i>Code</i>	<i>Description</i>
373.....	Car dropper	414.....	Laboratory assistant
374.....	Storekeeper		Analyst
	Blunger		Laboratory technician
	Process operator		Laboratory supervisor
	Sandbox operator		Quality control
	Mill operator		Dust sampler
	Reagent operator		Emission control specialist
	Car loader, surface	418.....	Maintenance supervisor
	Warehouseman		Maintenance foreman
	Shipping	423.....	Surveyor
	Media operator	430.....	Assistant mine manager
	Breakerman		Assistant mine foreman-vice president
	Crusher operator	449.....	Mine owner
	Sewing machine operator		Assayers
	Boney preparation plant operator		President
	Packaging		General foreman
	Cleaning plant operator		Mine manager
	Truck loader		Mine foreman
	Bagger-baler	456.....	Engineer
	Preparation plant operator		Metallurgist-geologist
	Cobber		Chemist
375.....	Grader operator, surface	464.....	Inspector
376.....	Truck driver, surface	481.....	Superintendents
378.....	Dragline operator		Project managers
	Dropball operator		Coordinators
	Crane operator, surface		Supervisors
379.....	Kiln operator	489.....	Outside foreman
	Calciner	494.....	Plant manager
	Dryer operator		Mill manager
380.....	Fine coal plant operator		Plant foreman
382.....	Loader operator		Mill foreman
	Front-end loader operator, surface	495.....	Safety coordinator
	Pan operator		Safety manager
	Scraper operator		Safety director
	Highlift operator		Environmental coordinator
	Payload operator		Safety engineer
385.....	Lampman	497.....	Office help
386.....	Refuse truck driver		Computer operator
387.....	Rotary bucket excavator operator		Controller
388.....	Separator operator		Clerk
	Scalper	593.....	Nurse
	Shaker operator	594.....	Training specialist
	Screen operator	601.....	Conveyor man
389.....	Forklift operator		Belt walker
390.....	Silo operator		Belt installer
392.....	Washery operator		Tunnel worker
	Topman		Tailpiece man
	Skip dumper		Belt mover
	Binman		Mobile bridge carrierman
	Scrubber operator		Beltman
	Tipple operator-attendant	602.....	Lineman
393.....	Scaleperson		Electrician
	Weighman-weighmaster	603.....	Electrician helper
394.....	Carpenter	604.....	Fueler
395.....	Water truck operator		Boilermaker
396.....	Watchman		Plumber
	Security guard		Pipefitter
398.....	Sawyer		Boiler operator
	Stone finishing		Pipe man
399.....	Dimension stone cutter-polisher		Boiler trainee
402.....	Master electrician		Mechanic
404.....	Master mechanic		Repairman
			Mill wright

<i>Code</i>	<i>Description</i>	<i>Code</i>	<i>Description</i>
605....	Mechanic helper	825....	Bobcat operator
608....	Mason	850....	Ramcar operator
609....	Supplyman		Shuttle car operator
	Material man		Buggy operator
616....	Rock picker	874....	Mine equipment operator
	Parts runner	920....	Cager
	Groundman	921....	Hoist operator
	Unit helper		Hoist engineer
	Bathhouse attendant		Shaftman
	Pointman	930....	Skip tender
	Laborer	957....	Scraper operator
	Slate picker	962....	Car runner, surface
	Roustabout		Trip rider
	Extra man		Brakeman
624....	Trainees		Flagman
	Apprentice		Car rider
663....	Ledgeman		Conductor
	Quarry man	965....	Dispatcher
	Miner, not elsewhere classified	969....	Swamper
	Shaft miner		Motorman
	Probeman		Switchman
710....	Propman	985....	Heavy equipment operator, surface
	Timberman		Mobile equipment operator, surface
716....	Cement man	996....	Feeder man
	Form man	997....	General or many equipment operator
	Grizzly tender	998....	Janitor
728....	Gizmo operator		Bag stenciler
	Load-haul-dump operator, underground		Prospector
749....	Shift boss		Painter
	Foreman-leadman	1012....	Belt repairman
	Bullgang foreman		Belt vulcanizer
	Labor foreman	1013....	Cleanup man
	Section boss-foreman	1014....	Sampler
768....	Heavy equipment operator	1018....	Lube man
775....	Grader operator, underground		Greaser-oiler
776....	Truck driver, underground	1019....	Welder
778....	Cherry picker	1022....	Dump man
	Crane operator, underground		Dump operator
	Dragline operator, underground	1055....	Chainman
	Backhoe operator, underground	1056....	Rock driller
	Gradall operator	1060....	Machinist
	Front-end loader operator, underground		Shopman
807....	Chargeman		Shop foreman
	Shot firer		Bit sharpener
	Powder man		
	Blaster		
	Airdox operator		
	Loading hole shooter		
	Powder monkey		



## APPENDIX B.—SAND AND GRAVEL MINING INDUSTRY EQUIPMENT OPERATED GROUPING

<i>Description</i>	<i>Equipment code</i>
Backhoe-crane-dragline-shovel .....	60, 14
Belt .....	13, 96
Dozer-heavy and mobile equipment .....	8, 85
Drill (underground)-rock bolter .....	53, 54, 49
Drill (surface) .....	9
Explosives .....	47
Front-end loader-forklift .....	24, 23
Grader-scraper .....	52, 57
Handtools (powered and nonpowered) .....	28
Many equipment .....	97
Miscellaneous utility equipment .....	95, 12, 16
Plant equipment .....	40, 7, 10, 11, 15, 18, 22, 26, 32, 39, 46, 51, 58, 69, 82,, 83
Pump .....	48
Scale-lab equipment-controls .....	92, 80, 91
Shuttle car-locomotive .....	61, 34, 33, 41, 42, 43, 65
Truck (haulage) .....	44, 45
Truck (utility)-personnel carrier .....	67, 37, 66
Welding machine-lathe .....	70, 5
None .....	0
Not elsewhere classified .....	98, 68, 71, 81, 88
Unspecified .....	99

<i>Code</i>	<i>Description</i>	<i>Code</i>	<i>Description</i>
0.....	None	14.....	Cherry picker
5.....	Drill press		Basket scaler
	Bench grinder		Scaling machine
	Lathe		Rock or dropball
7.....	Boats		Boom hoist
	Barges		Derrick
	Water transportation		Crane
8.....	Bulldozer		Gantry
	Dozer	15.....	Breaker
	Crawler tractor		Crusher
9.....	Carriage mounted drill	16.....	Cutting machines
	Jumbo drill		Undercutter
	Churn drill		Chain cutter
	Rotary drill	18.....	Dredge
	Jet piercing drill	22.....	Precipitator heavy media bath
	Airtrack compressor drill		Filters
10.....	Chute		Flotation machines
	Airslide	23.....	Forklift
11.....	Classifier	24.....	Highlift
	Cyclones		Skip tender
12.....	Continuous miner		Front-end loader
	Dosco miner		Payloader
13.....	Belt feeder	26.....	Grizzlies
	Mobile bridge carrier	28.....	Handtools (powered and nonpowered)
	Conveyor		Ram jack
	All types belts	32.....	Impactor

<i>Code</i>	<i>Description</i>	<i>Code</i>	<i>Description</i>
33.....	Scoop tram	54.....	Pinner
	Unitrac		Roof bolting mach
	Load-haul-dump	57.....	Pan scraper
	Teletram car		Scoop, surface
	Bobcat, underground		Self-loading scraper
34.....	Locomotive		Tractor scraper
	Trammer		Scraper loader
	Tow-motor	58.....	Shaker
	Lorry car		Vibrator
	Rail-mounted locomotive		Screen
37.....	Porta bus	60.....	Dragline
	Mancar		Dragline bucket
	Golf cart		Backhoe
	Mantrip		Power shovel
	Rail runner		Clamshell
	Rail rover	61.....	Buggy
	Personnel carrier		Shuttle car
	Boss buggy		Ram car
	Jeep	65.....	Track maintenance
39.....	Grinding mills		Track repair equipment
	Ball or rod mills	66.....	Tractor, underground
40.....	Milling machinery		Elkhorn
	Block press		Supply car
	General plant equipment	67.....	Trash truck
41.....	Nipper truck, underground		Service truck
	Mine car, underground		Utility truck
	Underground flatcar		Water truck
	Timber truck, underground		Dump truck
42.....	Mine car, surface		Pickup truck
	Ore-coal car, surface	68.....	Tugger
	Boxcar, surface		Air winch
	Hopper car, surface	69.....	Washers
43.....	Mucking machine	70.....	Welding machine
	Overshot loader		Torch
44.....	Ore haulage trucks, offhighway	71.....	Machines, not elsewhere classified
45.....	Payloader ore haulage, onhighway		Rock rake
46.....	Bagger		Drilling rigs
	Sewing machine		Impact roller
	Packaging machine	80.....	Lab equipment
47.....	Pneumatic blast agent loader	81.....	Rigs, not elsewhere classified
	Pop shooter	82.....	Boilers
	Driller loader	83.....	Furnaces
	Prill loader		Calciners
	Powder buggy		Kilns
	Explosives		Dryers
48.....	Pump	85.....	Heavy equipment
49.....	Raise borer		Mobile equipment
51.....	Raw coal storage	88.....	Diesels
	Tipple	91.....	Controls
	Dump bins		Consoles
52.....	Roadgrader	92.....	Scales
	Motor grader	95.....	Miscellaneous utility equipment
	Motor patrol	96.....	Feeders
53.....	Jackleg	97.....	Many-all types of equipment
	Drifter drill	98.....	Not elsewhere classified
	Airleg	99.....	Not specified
	Diamond drill		
	Track drill		
	Jumbo drill		
	Rock drill		
	Buzzy drill		
	Jackhammer		
	Hydraulic drill		
	Stoper drill		

## APPENDIX C.—ESTIMATION PROCEDURES

*Establishment weight.*—Suppose one out of every five mine establishments in a sampling stratum (industry-mine type-employment size class-status) was selected. Then, the sampling ratio is 1-5, and the establishment weight (EWT) is 5.00, the inverse of the sampling ratio.

*Nonresponse adjustment factor.*—Also suppose in a given sampling stratum, 80 pct of the establishments that were within the scope of the survey responded. Then, the nonresponse adjustment factor (NRAF) is 1.25 (i.e., 100/80).

*Worker weight.*—Additionally, there was the sampling ratio with which the workers in the establishment were sampled; the worker weight (WWT) ranged from 1.00 to 30.00 (see the first page of the MIPS questionnaire in appendix F). Theoretically, all the workers in a sampling stratum should have had the same weight. Hence, there would have been no need to assign weight at the worker level, as the worker weight could have been incorporated into the establishment weight. In practice, however, this is seldom the case because for a few establishments the employment level changes from what it was on the sampling frame to the time of the survey data collection. Since all the establishments did not report in the same employment size class that they were sampled in, it was necessary to also assign each worker a weight.

*Final weight.*—For the purpose of computing the estimates, each worker was assigned a final weight (FWT) which was the product of establishment weight (EWT), nonresponse adjustment factor (NRAF), and the worker weight (WWT). That is,  $FWT = EWT \times NRAF \times WWT$ .

*Estimates of number of workers.*—The estimates of the total number of workers were computed by (1) summing the final weights over the appropriate domain, and (2) rounding the sum to the nearest integer.

Example: To estimate the total number of truck drivers:

1. Compute  $x = \sum_{i \in D} FWT_i$ .

Where the domain,  $D$ , was the set of all records (workers) that had an occupation code of truck driver.

2. Compute  $y = \text{round}(x)$ .

*Estimates of mean.*—The estimates of mean age (training) were computed by summing over the appropriate domain (1) the product of age (training) and final weight, (2) the final weights, and then (3) dividing the sum of the products by the sum of the weights and rounding the result to the nearest whole number. It should be noted that for each domain only those entries where age (training) was specified were included in the computation.

Example: To estimate the mean age of the truck drivers:

1. Compute  $x = \sum_{i \in D} (\text{Age}_i * FWT_i)$ .
2. Compute  $y = \sum_{i \in D} FWT_i$ .

Where domain,  $D$ , is the set of all records that had an occupation code of truck driver with age being specified.

3. Compute  $z = \text{round}(x/y)$ .

*Estimates of median.*—The estimates of median job, company, and mining experience were derived by (1) sorting over the domain the records in ascending order of the experience for which the median statistic was desired, (2) computing the total number of workers (NW) in the domain by summing the final weights, and (3) selecting the experience corresponding to the middle worker(s) in the ordering. That is, if NW is an odd number, then the median experience is the experience corresponding to the  $(NW/2 + 1)$ th worker in the ordering; if NW is an even number, then the median experience is the midpoint (rounded to the nearest integer) of the experience corresponding to the  $(NW/2)$ th and  $(NW/2 + 1)$ th worker in the ordering. As with the mean estimates, the median estimates also excluded those entries in the domain with unspecified experience.

## APPENDIX D.—RELIABILITY OF ESTIMATES: RANDOM GROUP VARIANCE TECHNIQUE

The random group method of variance estimation employed in this study consisted of selecting eight samples using the same sampling scheme for each sample as the parent sample. The primary sampling units (establishments) were divided into two sets. The first set consisted of noncertainty (probability of selection less than 1.00) primary sampling units sorted by their original industry-mine type-employment size class-status. A random integer, say  $j$ , between 1 and 8 was generated. The first primary unit in the ordering was assigned to the random group  $j$ , the second to the random group  $j + 1$ , and so forth in a modulo 8 fashion. Then, the secondary sampling units (workers) were assigned the same random group number as the primary unit to which they belonged. The second set consisted of all secondary sampling units belonging to the certainty (probability of selection equal to 1.00) primary sampling units. The secondary sampling units were sorted by the same scheme as above, and a random integer, say  $k$ , between 1 and 8 was generated. Then, the first secondary unit in the ordering was assigned to the random group  $k$ , the second to the random group  $k + 1$ , and so forth in a modulo 8 fashion. Hence, each worker belonged to a random group. For a more detailed discussion of the random group technique, the reader is referred to reference 9 of the main text.

The following procedure was followed in computing the estimated variance (var), standard error (s), and the coefficient of variation (CV) for the estimated number of workers belonging to a particular category.

1. The domain (i.e., category) was defined.
2. A separate estimate for total number of workers,  $\hat{\theta}_i$ , for each of the eight random groups was computed. If any random group was empty, then a zero was assigned to that random group.
3. Total number of workers,  $\hat{\theta}$ , for all eight groups was computed as

$$\hat{\theta} = \hat{\theta}_1 + \hat{\theta}_2 + \dots + \hat{\theta}_8.$$

4. The mean number of workers per group was computed as

$$\bar{\theta} = \hat{\theta}/8.$$

5. The variance for  $\hat{\theta}$  was computed as

$$\text{var}(\hat{\theta}) = 8 \sum_{i=1}^8 \frac{(\hat{\theta}_i - \bar{\theta})^2}{7}.$$

6. The standard error of  $\hat{\theta}$  was computed as

$$s(\hat{\theta}) = \sqrt{\text{var}(\hat{\theta})}.$$

7. The CV for  $\hat{\theta}$  was computed as

$$\text{CV}(\hat{\theta}) = \frac{s(\hat{\theta})}{\hat{\theta}} \times 100.0.$$



## APPENDIX E.—SAND AND GRAVEL MINING 1986 WORKFORCE ESTIMATES

Table E-1.—Sand and gravel mining 1986 workforce estimates: job title, by employment size class<sup>1</sup>

Job title grouping <sup>2</sup>	1-19		20-49		50-249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel operator . . . . .	932	4	251	3	96	3	1,279	3
Beltman-belt repairman . . . . .	58	0	103	1	47	2	208	1
Blaster . . . . .	3	0	0	0	0	0	3	0
Deckhand-barge and dredge operator . . . . .	598	2	211	2	44	2	853	2
Dozer-heavy and mobile equipment operator . . . . .	1,046	4	214	2	121	4	1,381	4
Driller-rock bolter . . . . .	21	0	24	0	11	0	56	0
Electrician-lampman . . . . .	3	0	27	0	45	2	75	0
Front-end loader-forklift operator . . . . .	4,867	19	859	9	207	7	5,933	16
Grader-scraper operator . . . . .	217	1	121	1	14	1	352	1
Laborer-miner-utility man . . . . .	1,818	7	866	9	235	8	2,918	8
Manager-foreman-supervisor:								
General . . . . .	2,662	11	695	8	109	4	3,466	9
Maintenance . . . . .	11	0	16	0	14	0	40	0
Working . . . . .	155	1	147	2	85	3	387	1
Mechanic-welder-oiler-machinist . . . . .	1,495	6	1,234	14	571	21	3,299	9
Mine technical support . . . . .	919	4	397	4	123	4	1,439	4
Office worker . . . . .	2,201	9	740	8	247	9	3,188	9
Plant operator-warehouseman . . . . .	2,862	11	721	8	335	12	3,918	11
Shuttle car-tram operator . . . . .	11	0	14	0	7	0	32	0
Truck driver . . . . .	5,324	21	2,478	27	473	17	8,274	22
Total . . . . .	25,200	100	9,117	100	2,783	100	37,100	100

<sup>1</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

<sup>2</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-2.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by employment size class<sup>2</sup>

Equipment operated grouping <sup>3</sup>	1-19		20-49		50-249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel . . . . .	969	4	258	3	96	4	1,323	4
Belt . . . . .	80	0	130	2	37	1	247	1
Dozer-heavy and mobile equipment . . . . .	808	4	246	3	110	4	1,164	3
Drill (underground)-rock bolter . . . . .	3	0	0	0	0	0	3	0
Drill (surface) . . . . .	17	0	24	0	11	0	52	0
Explosives . . . . .	3	0	0	0	0	0	3	0
Front-end loader-forklift . . . . .	5,496	24	921	11	223	9	6,640	20
Grader-scraper . . . . .	254	1	123	1	23	1	400	1
Handtools (powered and nonpowered) . . . . .	1,333	6	973	12	481	19	2,787	8
Many equipment . . . . .	276	1	51	1	0	0	326	1
Miscellaneous utility equipment . . . . .	953	4	620	7	160	6	1,733	5
Plant equipment . . . . .	3,872	17	859	10	314	12	5,045	15
Pump . . . . .	212	1	0	0	4	0	216	1
Scale-lab equipment-controls . . . . .	625	3	281	3	79	3	985	3
Shuttle car-locomotive . . . . .	0	0	14	0	7	0	21	0
Truck (haulage) . . . . .	5,523	24	2,498	30	479	19	8,501	25
Truck (utility)-personnel carrier . . . . .	107	0	72	1	31	1	211	1
Welding machine-lathe . . . . .	308	1	326	4	174	7	808	2
None . . . . .	2,118	9	905	11	278	11	3,300	10
Not elsewhere classified . . . . .	19	0	35	0	3	0	57	0
Unspecified . . . . .	23	0	42	0	25	1	90	0
Total . . . . .	22,999	100	8,377	100	2,536	100	33,912	100

<sup>1</sup>Excluding job title category of office workers.

<sup>2</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

<sup>3</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-3.—Sand and gravel mining 1986 workforce estimates: work location at mine, by employment size class<sup>1</sup>

Work location	1-19		20-49		50-249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Surface mine . . . . .	18,388	73	6,284	69	1,959	70	26,631	72
Plant or mill . . . . .	3,728	15	1,797	20	502	18	6,026	16
Office . . . . .	3,085	12	1,035	11	322	12	4,443	12
Total . . . . .	25,200	100	9,117	100	2,783	100	37,100	100

<sup>1</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-4.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, company, and mining, by employment size class<sup>2</sup>

Experience, yr	1-19		20-49		50-249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
At present job:								
0< to ≤1	4,598	20	1,504	18	523	21	6,625	20
1< to ≤2	2,741	12	755	9	316	12	3,812	11
2< to ≤3	2,387	10	582	7	245	10	3,214	9
3< to ≤5	2,985	13	803	10	143	6	3,932	12
5< to ≤10	3,910	17	1,379	16	568	22	5,856	17
10< to ≤20	3,636	16	917	11	332	13	4,884	14
20<	1,428	6	527	6	217	9	2,172	6
Unspecified	1,313	6	1,911	23	193	8	3,417	10
Total	22,999	100	8,377	100	2,536	100	33,912	100
Median . . . . .yr.	4	NAP	5	NAP	5	NAP	4	NAP
At present company:								
0< to ≤1	3,865	17	1,477	18	477	19	5,818	17
1< to ≤5	7,800	34	2,320	28	578	23	10,698	32
5< to ≤10	4,396	19	1,641	20	606	24	6,642	20
10< to ≤15	2,774	12	896	11	264	10	3,934	12
15< to ≤20	1,479	6	711	8	228	9	2,418	7
20< to ≤25	680	3	439	5	161	6	1,281	4
25< to ≤30	486	2	303	4	94	4	883	3
30<	524	2	347	4	129	5	999	3
Unspecified	995	4	243	3	0	0	1,238	4
Total	22,999	100	8,377	100	2,536	100	33,912	100
Median . . . . .yr.	5	NAP	7	NAP	7	NAP	5	NAP
Total mining:								
0< to ≤1	2,282	10	809	10	348	14	3,439	10
1< to ≤5	5,643	25	1,245	15	487	19	7,375	22
5< to ≤10	4,139	18	1,165	14	548	22	5,852	17
10< to ≤15	2,902	13	675	8	259	10	3,835	11
15< to ≤20	1,803	8	455	5	208	8	2,466	7
20< to ≤25	972	4	238	3	150	6	1,361	4
25< to ≤30	643	3	188	2	81	3	912	3
30<	778	3	246	3	90	4	1,114	3
Unspecified	3,837	17	3,355	40	367	14	7,558	22
Total	22,999	100	8,377	100	2,536	100	33,912	100
Median . . . . .yr.	8	NAP	8	NAP	7	NAP	8	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-5.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> training received, by employment size class<sup>2</sup>

Job training for last 2 yr, h	1-19		20-49		50-249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0	4,907	21	1,098	13	127	5	6,132	18
1-8	1,946	8	387	5	176	7	2,509	7
9-15	605	3	167	2	130	5	902	3
16	2,414	10	1,422	17	401	16	4,238	12
17-40	2,647	12	860	10	252	10	3,759	11
41-80	1,661	7	569	7	557	22	2,786	8
81-160	792	3	76	1	79	3	947	3
161+	625	3	72	1	36	1	733	2
Unspecified	7,402	32	3,726	44	778	31	11,905	35
Total	22,999	100	8,377	100	2,536	100	33,912	100
Mean job training . . . . .h.	38	NAP	27	NAP	39	NAP	35	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-6.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> age distribution, by employment size class<sup>2</sup>

Age, yr	1 to 19		20 to 49		50 to 249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
15-20.....	443	2	187	2	91	4	722	2
21-23.....	1,247	5	339	4	158	6	1,745	5
24-26.....	2,215	10	508	6	157	6	2,881	8
27-29.....	2,084	9	612	7	224	9	2,920	9
30-34.....	3,099	13	1,067	13	348	14	4,514	13
35-39.....	2,962	13	1,014	12	347	14	4,323	13
40-49.....	4,465	19	1,597	19	521	21	6,583	19
50+.....	5,322	23	1,944	23	554	22	7,821	23
Unspecified.....	1,161	5	1,108	13	135	5	2,404	7
Total.....	22,999	100	8,377	100	2,536	100	33,912	100
Mean age.....yr..	39	NAp	40	NAp	39	NAp	39	NAp

NAp Not applicable.

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-7.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> sex, race, and education, by employment size class<sup>2</sup>

	1 to 19		20 to 49		50 to 249		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Sex:								
Male.....	22,239	97	8,231	98	2,478	98	32,949	97
Female.....	600	3	132	2	58	2	790	2
Unspecified.....	160	1	14	0	0	0	174	1
Total.....	22,999	100	8,377	100	2,536	100	33,912	100
Race:								
White.....	20,242	88	6,622	79	1,780	70	28,644	84
Black.....	936	4	501	6	305	12	1,742	5
Hispanic.....	1,253	5	891	11	304	12	2,448	7
Other.....	338	1	83	1	35	1	456	1
Unspecified.....	230	1	280	3	112	4	622	2
Total.....	22,999	100	8,377	100	2,536	100	33,912	100
Education level:								
Some elementary.....	1,674	7	898	11	239	9	2,812	8
Some high school.....	4,342	19	1,239	15	449	18	6,030	18
High school diploma.....	11,311	49	3,441	41	1,040	41	15,792	47
Vocational diploma.....	1,676	7	249	3	246	10	2,171	6
Some college.....	1,482	6	540	6	190	8	2,212	7
College degree.....	617	3	188	2	74	3	879	3
Unspecified.....	1,897	8	1,820	22	297	12	4,015	12
Total.....	22,999	100	8,377	100	2,536	100	33,912	100

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.



Table E-8.—Sand and gravel mining 1986 workforce estimates: job title, by principal equipment operated,<sup>1</sup> number of workers

Job title grouping <sup>2</sup>	Backhoe crane dragline shovel	Belt	Dozer heavy and mobile equip- ment	Drill (under- ground) rock bolter	Drill (surface)	Explo- sives	Front-end loader forklift	Grader scraper	Handtools (powered and non- powered)
Backhoe-crane-dragline-shovel operator . . . . .	1,199	0	0	0	0	0	27	0	0
Beltman-belt repairman . . . . .	0	194	3	0	0	0	0	0	3
Blaster . . . . .	0	0	0	0	0	3	0	0	0
Deckhand-barge and dredge operator . . . . .	3	7	0	0	0	0	0	0	0
Dozer-heavy and mobile equipment operator . . . . .	37	0	1,047	0	0	0	147	20	0
Driller-rock bolter . . . . .	0	0	0	3	52	0	0	0	0
Electrician-lampman . . . . .	0	0	0	0	0	0	0	0	75
Front-end loader-forklift operator . . . . .	0	0	19	0	0	0	5,897	0	0
Grader-scraper operator . . . . .	0	0	0	0	0	0	0	352	0
Laborer-miner-utility man . . . . .	0	20	11	0	0	0	150	16	173
Manager-foreman-supervisor:									
General . . . . .	80	11	59	0	0	0	285	11	9
Maintenance . . . . .	3	0	0	0	0	0	0	0	0
Working . . . . .	0	0	11	0	0	0	30	0	5
Mechanic-welder-oiler-machinist . . . . .	0	0	0	0	0	0	0	0	2,518
Mine technical support . . . . .	0	0	0	0	0	0	5	0	0
Office worker . . . . .	0	0	0	0	0	0	0	0	0
Plant operator-warehouseman . . . . .	0	15	14	0	0	0	77	0	4
Shuttle car-tram operator . . . . .	0	0	0	0	0	0	0	0	0
Truck driver . . . . .	0	0	0	0	0	0	21	2	0
Total . . . . .	1,323	247	1,164	3	52	3	6,640	400	2,787
	Many equip- ment	Miscel- laneous utility equip- ment	Plant equip- ment	Pump	Scale-lab equip- ment controls	Shuttle car loco- motive	Truck (haulage)	Truck (utility) personnel carrier	Welding machine lathe
Backhoe-crane-dragline-shovel operator . . . . .	0	28	21	0	0	0	0	0	0
Beltman-belt repairman . . . . .	0	0	7	0	0	0	0	0	0
Blaster . . . . .	0	0	0	0	0	0	0	0	0
Deckhand-barge and dredge operator . . . . .	0	75	734	5	0	0	0	0	0
Dozer-heavy and mobile equipment operator . . . . .	0	0	21	0	0	0	110	0	0
Driller-rock bolter . . . . .	0	0	0	0	0	0	0	0	0
Electrician-lampman . . . . .	0	0	0	0	0	0	0	0	0
Front-end loader-forklift operator . . . . .	0	0	0	0	0	0	16	0	0
Grader-scraper operator . . . . .	0	0	0	0	0	0	0	0	0
Laborer-miner-utility man . . . . .	162	1,630	304	184	14	0	16	74	0
Manager-foreman-supervisor:									
General . . . . .	155	0	271	27	11	0	72	98	16
Maintenance . . . . .	0	0	0	0	0	0	0	0	0
Working . . . . .	9	0	58	0	0	0	14	6	14
Mechanic-welder-oiler-machinist . . . . .	0	0	0	0	0	0	0	3	778
Mine technical support . . . . .	0	0	5	0	929	0	5	15	0
Office worker . . . . .	0	0	0	0	23	0	0	21	0
Plant operator-warehouseman . . . . .	0	0	3,624	0	32	3	17	11	0
Shuttle car-tram operator . . . . .	0	0	0	0	0	18	0	3	0
Truck driver . . . . .	0	0	0	0	0	0	8,251	0	0
Total . . . . .	326	1,733	5,045	216	1,008	21	8,501	232	808

See explanatory notes at end of table.

Table E-8.—Sand and gravel mining 1986 workforce estimates: job title, by principal equipment operated,<sup>1</sup> number of workers—Con.

Job title grouping <sup>2</sup>	None	Not elsewhere classified	Unspecified	Total
Backhoe-crane-dragline-shovel operator . . . . .	4	0	0	1,279
Beltman-belt repairman . . . . .	0	0	0	208
Blaster . . . . .	0	0	0	3
Deckhand-barge and dredge operator . . . . .	0	28	0	853
Dozer-heavy and mobile equipment operator . . . . .	0	0	0	1,381
Driller-rock bolter . . . . .	0	0	0	56
Electrician-lampman . . . . .	0	0	0	75
Front-end loader-forklift operator . . . . .	0	0	0	5,933
Grader-scraper operator . . . . .	0	0	0	352
Laborer-miner-utility man . . . . .	74	17	74	2,918
Manager-foreman-supervisor:				
General . . . . .	2,361	0	0	3,466
Maintenance . . . . .	37	0	0	40
Working . . . . .	241	0	0	387
Mechanic-welder-oiler-machinist . . . . .	0	0	0	3,299
Mine technical support . . . . .	471	8	0	1,439
Office worker . . . . .	3,144	0	0	3,188
Plant operator-warehouseman . . . . .	102	3	16	3,918
Shuttle car-tram operator . . . . .	11	0	0	32
Truck driver . . . . .	0	0	0	8,274
Total . . . . .	6,444	57	90	37,100

<sup>1</sup>See appendix B for detailed explanation of equipment operated grouping.<sup>2</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-9.—Sand and gravel mining 1986 workforce estimates: job title, by work location at mine, number of workers

Job title grouping <sup>1</sup>	Surface mine	Plant or mill	Office	Total
Backhoe-crane-dragline-shovel operator . . . . .	1,267	12	0	1,279
Beltman-belt repairman . . . . .	156	52	0	208
Blaster . . . . .	3	0	0	3
Deckhand-barge and dredge operator . . . . .	807	45	0	853
Dozer-heavy and mobile equipment operator . . . . .	1,360	20	0	1,381
Driller-rock bolter . . . . .	56	0	0	56
Electrician-lampman . . . . .	62	13	0	75
Front-end loader-forklift operator . . . . .	5,470	462	0	5,933
Grader-scraper operator . . . . .	336	16	0	352
Laborer-miner-utility man . . . . .	2,434	484	0	2,918
Manager-foreman-supervisor:				
General . . . . .	2,582	580	303	3,466
Maintenance . . . . .	21	15	3	40
Working . . . . .	272	91	24	387
Mechanic-welder-oiler-machinist . . . . .	2,696	604	0	3,299
Mine technical support . . . . .	418	110	911	1,439
Office worker . . . . .	0	0	3,188	3,188
Plant operator-warehouseman . . . . .	1,004	2,901	13	3,918
Shuttle car-tram operator . . . . .	28	3	0	32
Truck driver . . . . .	7,657	618	0	8,274
Total . . . . .	26,631	6,026	4,443	37,100

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-10.—Sand and gravel mining 1986 workforce estimates: job title, by years of experience at job

Job title grouping <sup>1</sup>	0< to ≤1	1< to ≤2	2< to ≤3	3< to ≤5	5< to ≤10	10< to ≤20	20<	Unspeci- fied	Total	Median, yr
Backhoe-crane-dragline-shovel operator . . . . .	253	72	92	137	281	268	140	36	1,279	7
Beltman-belt repairman . . . . .	63	52	14	24	31	7	11	6	208	2
Blaster . . . . .	0	0	3	0	0	0	0	0	3	3
Deckhand-berge and dredge operator . . . . .	138	107	74	114	215	105	41	58	853	4
Dozer-heavy and mobile equipment operator . . . . .	280	165	112	112	293	174	79	165	1,381	4
Driller-rock bolter . . . . .	7	3	3	7	19	9	0	7	56	7
Electrician-lampman . . . . .	13	16	4	7	15	9	7	6	75	4
Front-end loader-forklift operator . . . . .	965	689	679	792	932	1,063	379	433	5,933	4
Grader-scraper operator . . . . .	66	27	35	54	56	68	16	30	352	5
Laborer-miner-utility man . . . . .	1,019	334	316	283	354	204	108	299	2,918	2
Manager-foreman-supervisor:										
General . . . . .	278	211	316	347	730	809	554	220	3,466	9
Maintenance . . . . .	4	3	0	7	7	3	16	0	40	9
Working . . . . .	97	22	14	58	70	76	34	17	387	5
Mechanic-welder-oiler-machinist . . . . .	716	371	334	359	665	424	152	279	3,299	4
Mine technical support . . . . .	421	162	117	113	249	131	62	186	1,439	3
Office worker . . . . .	486	437	307	262	581	562	220	333	3,188	5
Plant operator-warehouseman . . . . .	749	497	328	550	767	523	192	313	3,918	4
Shuttle car-tram operator . . . . .	3	4	0	11	7	3	3	0	32	4
Truck driver . . . . .	1,553	1,077	772	957	1,165	1,008	379	1,363	8,274	4
Total . . . . .	7,111	4,249	3,521	4,194	6,436	5,447	2,391	3,751	37,100	4

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-11.—Sand and gravel mining 1986 workforce estimates: job title, by years of experience at company

Job title grouping <sup>1</sup>	0< to ≤1	1< to ≤5	5< to ≤10	10< to ≤15	15< to ≤20	20< to ≤25	25< to ≤30	30<	Unspeci- fied	Total	Median, yr
Backhoe-crane-dragline-shovel operator . . . . .	199	297	279	200	118	61	56	64	5	1,279	8
Beltman-belt repairman . . . . .	43	73	54	3	7	11	3	10	3	208	4
Blaster . . . . .	0	3	0	0	0	0	0	0	0	3	3
Deckhand-berge and dredge operator . . . . .	101	206	270	130	35	40	14	19	37	853	7
Dozer-heavy and mobile equipment operator . . . . .	251	444	318	121	102	50	7	19	70	1,381	5
Driller-rock bolter . . . . .	9	9	22	9	0	0	0	0	7	56	7
Electrician-lampman . . . . .	28	21	16	0	0	3	0	7	0	75	2
Front-end loader-forklift operator . . . . .	818	1,922	1,148	699	465	253	163	210	253	5,933	6
Grader-scraper operator . . . . .	89	122	47	63	7	10	14	0	0	352	4
Laborer-miner-utility man . . . . .	1,068	868	453	191	105	61	31	60	81	2,918	3
Manager-foreman-supervisor:											
General . . . . .	130	751	710	606	436	198	283	245	107	3,466	12
Maintenance . . . . .	0	7	12	3	2	4	5	7	0	40	14
Working . . . . .	7	107	73	44	73	37	15	31	0	387	12
Mechanic-welder-oiler-machinist . . . . .	667	1,100	684	336	177	114	61	63	97	3,299	4
Mine technical support . . . . .	374	487	268	128	93	28	21	12	28	1,439	3
Office worker . . . . .	557	982	605	344	241	116	81	88	174	3,188	5
Plant operator-warehouseman . . . . .	543	1,320	921	517	234	94	61	117	111	3,918	6
Shuttle car-tram operator . . . . .	0	14	7	0	3	3	0	3	0	32	8
Truck driver . . . . .	1,491	2,946	1,360	883	563	314	148	132	438	8,274	4
Total . . . . .	6,375	11,681	7,247	4,278	2,659	1,397	964	1,087	1,412	37,100	5

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.



Table E-12.—Sand and gravel mining 1986 workforce estimates: job title, by years of mining experience

Job title grouping <sup>1</sup>	0< to ≤1	1< to ≤5	5< to ≤10	10< to ≤15	15< to ≤20	20< to ≤25	25< to ≤30	30<	Unspeci- fied	Total	Median, yr
Backhoe-crane-dragline-shovel operator . . . . .	113	191	270	186	155	98	73	92	101	1,279	11
Beltman-belt repairman . . . . .	26	52	62	0	14	7	3	3	39	208	7
Blaster . . . . .	0	3	0	0	0	0	0	0	0	3	3
Deckhand-barge and dredge operator . . . . .	70	155	243	127	51	24	32	13	139	853	8
Dozer-heavy and mobile equipment operator . . . . .	143	225	317	133	135	88	21	22	296	1,381	8
Driller-rock bolter . . . . .	0	5	26	9	0	3	0	0	12	56	8
Electrician-lampman . . . . .	12	21	16	11	0	3	0	7	5	75	6
Front-end loader-forklift operator . . . . .	306	1,413	1,107	720	517	271	176	277	1,145	5,933	9
Grader-scraper operator . . . . .	37	92	56	67	7	7	14	0	74	352	6
Laborer-miner-utility man . . . . .	834	684	408	147	123	58	23	60	581	2,918	3
Manager-foreman-supervisor:											
General . . . . .	46	413	522	703	367	253	255	299	606	3,466	15
Maintenance . . . . .	0	3	12	3	2	4	9	4	3	40	14
Working . . . . .	0	35	70	38	83	23	14	32	93	387	16
Mechanic-welder-oiler-machinist . . . . .	368	676	622	350	244	109	51	54	826	3,299	7
Mine technical support . . . . .	279	339	230	109	65	18	18	14	367	1,439	4
Office worker . . . . .	350	705	441	245	183	120	104	85	957	3,188	6
Plant operator-warehouseman . . . . .	295	1,124	812	517	283	180	79	121	507	3,918	7
Shuttle car-tram operator . . . . .	0	4	7	0	3	3	0	0	14	32	10
Truck driver . . . . .	909	1,940	1,073	715	415	211	144	116	2,750	8,274	5
Total . . . . .	3,788	8,080	6,293	4,079	2,649	1,481	1,016	1,199	8,515	37,100	7

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-13.—Sand and gravel mining 1986 workforce estimates: job title, by hours of training received in last 2 years

Job title grouping <sup>1</sup>	0	1-8	9-15	16	17-40	41-80	81-160	161+	Unspeci- fied	Total	Mean, h
Backhoe-crane-dragline-shovel operator . . . . .	220	96	41	222	157	64	41	34	404	1,279	36
Beltman-belt repairman . . . . .	41	17	3	44	3	40	11	4	44	208	32
Blaster . . . . .	0	0	0	0	0	0	0	0	3	3	NS
Deckhand-barge and dredge operator . . . . .	162	35	18	129	127	79	37	21	244	853	38
Dozer-heavy and mobile equipment operator . . . . .	315	159	12	143	111	78	28	28	507	1,381	33
Driller-rock bolter . . . . .	10	4	0	14	12	0	5	0	11	56	30
Electrician-lampman . . . . .	5	3	7	21	7	3	9	0	20	75	34
Front-end loader-forklift operator . . . . .	1,097	583	135	807	692	503	194	148	1,773	5,933	35
Grader-scraper operator . . . . .	35	11	12	26	45	42	0	0	181	352	29
Laborer-miner-utility man . . . . .	548	207	95	255	204	284	82	90	1,153	2,918	59
Manager-foreman-supervisor:											
General . . . . .	736	158	44	468	404	248	93	47	1,267	3,466	31
Maintenance . . . . .	6	0	0	5	0	12	7	5	4	40	77
Working . . . . .	42	2	12	41	39	46	30	14	162	387	62
Mechanic-welder-oiler-machinist . . . . .	533	227	85	536	367	280	72	82	1,117	3,299	36
Mine technical support . . . . .	244	118	48	134	174	147	28	39	508	1,439	36
Office worker . . . . .	911	131	41	169	144	216	68	86	1,422	3,188	39
Plant operator-warehouseman . . . . .	585	306	118	486	633	347	117	141	1,185	3,918	39
Shuttle car-tram operator . . . . .	0	3	0	3	3	7	0	0	14	32	45
Truck driver . . . . .	1,553	580	272	903	779	605	192	81	3,309	8,274	26
Total . . . . .	7,043	2,640	943	4,406	3,903	3,002	1,015	819	13,328	37,100	36

NS Not significant.

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-14.—Sand and gravel mining 1986 workforce estimates: job title, by years of age

Job title grouping <sup>1</sup>	15-20	21-23	24-26	27-29	30-34	35-39	40-49	50+	Unspeci- fied	Total	Mean, yr
Backhoe-crane-dragline-shovel operator . . . . .	21	26	79	77	153	158	297	438	29	1,279	44
Beltman-belt repairman . . . . .	3	10	10	31	17	25	44	50	17	208	41
Blaster . . . . .	0	0	0	0	0	0	0	0	3	3	NS
Deckhand-barge and dredge operator . . . . .	9	41	63	96	147	89	168	191	49	853	39
Dozer-heavy and mobile equipment operator . . . . .	3	53	132	106	193	128	287	321	158	1,381	40
Driller-rock bolter . . . . .	0	5	3	0	17	0	11	13	7	56	38
Electrician-lampman . . . . .	9	0	4	4	11	5	16	24	3	75	40
Front-end loader-forklift operator . . . . .	107	313	559	606	726	747	1,123	1,359	394	5,933	39
Grader-scraper operator . . . . .	0	5	34	17	68	32	111	64	21	352	41
Laborer-miner-utility man . . . . .	234	430	461	220	378	234	332	449	179	2,918	34
Manager-foreman-supervisor:											
General . . . . .	0	40	106	149	366	537	853	1,250	165	3,466	45
Maintenance . . . . .	0	7	7	0	3	2	9	15	3	40	44
Working . . . . .	11	3	11	14	77	44	106	115	7	387	42
Mechanic-welder-oiler-machinist . . . . .	88	144	209	325	527	524	674	633	176	3,299	39
Mine technical support . . . . .	69	112	136	114	201	170	237	342	59	1,439	39
Office worker . . . . .	131	172	257	202	352	478	630	737	229	3,188	40
Plant operator-warehouseman . . . . .	51	250	339	394	527	542	761	859	195	3,918	39
Shuttle car-tram operator . . . . .	0	0	0	14	0	3	3	11	0	32	42
Truck driver . . . . .	117	312	729	754	1,102	1,084	1,552	1,687	937	8,274	39
Total . . . . .	853	1,917	3,137	3,122	4,866	4,801	7,213	8,558	2,633	37,100	40

NS Not significant.

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-15.—Sand and gravel mining 1986 workforce estimates: job title, by sex

Job title grouping <sup>1</sup>	Male		Female		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel operator . . . . .	1,268	4	11	0	0	0	1,279	3
Beltman-belt repairman . . . . .	208	1	0	0	0	0	208	1
Blaster . . . . .	3	0	0	0	0	0	3	0
Deckhand-barge and dredge operator . . . . .	853	3	0	0	0	0	853	2
Dozer-heavy and mobile equipment operator . . . . .	1,370	4	0	0	11	5	1,381	4
Driller-rock bolter . . . . .	56	0	0	0	0	0	56	0
Electrician-lampman . . . . .	75	0	0	0	0	0	75	0
Front-end loader-forklift operator . . . . .	5,876	17	11	0	46	23	5,933	16
Grader-scraper operator . . . . .	352	1	0	0	0	0	352	1
Laborer-miner-utility man . . . . .	2,851	8	57	2	11	5	2,918	8
Manager-foreman-supervisor:								
General . . . . .	3,348	10	86	3	31	16	3,466	9
Maintenance . . . . .	42	0	0	0	0	0	42	0
Working . . . . .	387	1	0	0	0	0	387	1
Mechanic-welder-oiler-machinist . . . . .	3,293	10	3	0	3	2	3,299	9
Mine technical support . . . . .	906	3	522	19	10	5	1,439	4
Office worker . . . . .	1,139	3	2,024	72	25	12	3,188	9
Plant operator-warehouseman . . . . .	3,847	11	38	1	32	16	3,918	11
Shuttle car-tram operator . . . . .	32	0	0	0	0	0	32	0
Truck driver . . . . .	8,182	24	62	2	30	15	8,274	22
Total . . . . .	34,088	100	2,814	100	199	100	37,101	100

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-16.—Sand and gravel mining 1986 workforce estimates: job title, by race

Job title grouping <sup>1</sup>	White		Black		Hispanic		Other		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel operator . . . . .	1,118	4	56	3	80	3	12	3	13	2	1,279	3
Beltman-belt repairman . . . . .	104	0	39	2	48	2	11	2	7	1	208	1
Blaster . . . . .	3	0	0	0	0	0	0	0	0	0	3	0
Deckhand-barge and dredge operator . . . . .	780	2	61	3	11	0	0	0	0	0	853	2
Dozer-heavy and mobile equipment operator . . . . .	1,118	4	47	3	105	4	56	12	54	8	1,381	4
Driller-rock bolter . . . . .	31	0	0	0	21	1	0	0	3	0	56	0
Electrician-lampman . . . . .	61	0	0	0	7	0	3	1	4	1	75	0
Front-end loader-forklift operator . . . . .	5,161	16	279	16	340	13	85	18	67	9	5,933	16
Grader-scraper operator . . . . .	295	1	0	0	40	2	3	1	14	2	352	1
Laborer-miner-utility man . . . . .	2,015	6	270	15	502	20	65	14	66	9	2,918	8
Manager-foreman-supervisor:												
General . . . . .	3,274	10	37	2	85	3	21	4	49	7	3,466	9
Maintenance . . . . .	31	0	0	0	5	0	0	0	4	1	40	0
Working . . . . .	350	1	20	1	7	0	0	0	11	2	387	1
Mechanic-welder-oiler- machinist . . . . .	2,689	9	140	8	363	14	56	12	52	7	3,299	9
Mine technical support . . . . .	1,323	4	34	2	53	2	9	2	21	3	1,439	4
Office worker . . . . .	2,973	9	40	2	76	3	12	3	87	12	3,188	9
Plant operator-warehouseman . . . . .	3,252	10	266	15	293	12	73	16	33	5	3,918	11
Shuttle car-tram operator . . . . .	14	0	7	0	0	0	0	0	11	2	32	0
Truck driver . . . . .	7,024	22	487	27	489	19	60	13	214	30	8,274*	22
Total . . . . .	31,617	100	1,783	100	2,523	100	468	100	709	100	37,100	100

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-17.—Sand and gravel mining 1986 workforce estimates: job title, by education

Job title grouping <sup>1</sup>	Some elementary		Some high school		High school diploma		Vocational diploma		Some college		College degree		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel operator . . . . .	181	14	212	17	644	50	91	7	100	8	0	0	51	4	1,279	3
Beltman-belt repairman . . . . .	28	13	50	24	82	39	13	6	18	8	0	0	17	8	208	1
Blaster . . . . .	0	0	0	0	3	100	0	0	0	0	0	0	0	0	3	0
Deckhand-barge and dredge operator . . . . .	65	8	206	24	478	56	55	6	17	2	7	1	25	3	853	2
Dozer-heavy and mobile equipment operator . . . . .	161	12	220	16	726	53	65	5	67	5	27	2	115	8	1,381	4
Driller-rock bolter . . . . .	9	16	4	6	17	30	5	9	4	6	0	0	18	31	56	0
Electrician-lampman . . . . .	0	0	3	5	30	39	32	43	3	4	3	5	3	5	75	0
Front-end loader-forklift operator . . . . .	471	8	1,068	18	3,023	51	419	7	240	4	81	1	631	11	5,933	16
Grader-scraper operator . . . . .	28	8	82	23	163	46	9	2	3	1	0	0	67	19	352	1
Laborer-miner-utility man . . . . .	487	17	629	22	1,055	36	109	4	109	4	21	1	508	17	2,918	8
Manager-foreman-supervisor:																
General . . . . .	111	3	434	13	1,486	43	177	5	581	17	364	11	313	9	3,466	9
Maintenance . . . . .	0	0	12	29	14	35	7	18	0	0	3	9	4	9	40	0
Working . . . . .	11	3	61	16	129	33	18	5	68	18	25	6	75	19	387	1
Mechanic-welder-oiler- machinist . . . . .	266	8	527	16	1,363	41	372	11	262	8	43	1	467	14	3,299	9
Mine technical support . . . . .	21	1	114	8	637	44	88	6	225	16	168	12	187	13	1,439	4
Office worker . . . . .	20	1	99	3	1,415	44	164	5	815	26	527	17	149	5	3,188	9
Plant operator-warehouseman . . . . .	358	9	770	20	1,920	49	218	6	187	5	63	2	402	10	3,918	11
Shuttle car-tram operator . . . . .	3	11	0	0	14	44	0	0	7	22	0	0	7	23	32	0
Truck driver . . . . .	613	7	1,639	20	4,009	48	492	6	320	4	74	1	1,126	14	8,274	22
Total . . . . .	2,831	8	6,129	17	17,207	46	2,335	6	3,027	8	1,406	4	4,164	11	37,100	100

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.



Table E-18.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by years of experience at job

Equipment operated grouping <sup>2</sup>	0< to ≤1	1< to ≤2	2< to ≤3	3< to ≤5	5< to ≤10	10< to ≤20	20<	Unspeci- fied	Total	Median, yr
Backhoe-crane-dragline-shovel . . . . .	223	72	90	134	300	276	193	36	1,323	7
Belt . . . . .	59	54	14	24	48	14	17	17	247	3
Dozer-heavy and mobile equipment . . . . .	271	126	98	127	233	157	79	73	1,164	5
Drill (underground)-rock bolter . . . . .	0	0	3	0	0	0	0	0	3	3
Drill (surface) . . . . .	7	3	0	7	19	9	0	7	52	8
Explosives . . . . .	0	0	3	0	0	0	0	0	3	3
Front-end loader-forklift . . . . .	1,078	762	709	858	1,054	1,213	428	537	6,640	5
Grader-scraper . . . . .	77	36	35	54	72	81	16	30	400	5
Handtools (powered and nonpowered) . . . . .	634	314	259	341	525	379	132	205	2,787	4
Many equipment . . . . .	64	16	35	21	32	67	69	23	326	8
Miscellaneous utility equipment . . . . .	708	217	145	109	176	116	45	216	1,733	2
Plant equipment . . . . .	918	628	458	749	1,008	651	237	395	5,045	4
Pump . . . . .	21	0	16	37	57	42	16	27	216	7
Scale-lab equipment-controls . . . . .	303	109	82	74	161	85	37	134	985	3
Shuttle car-locomotive . . . . .	7	4	0	0	7	3	0	0	21	5
Truck (haulage) . . . . .	1,583	1,083	794	971	1,217	1,056	416	1,382	8,501	4
Truck (utility)-personnel carrier . . . . .	31	3	42	28	41	14	30	21	211	4
Welding machine-lathe . . . . .	159	119	104	48	180	80	34	83	808	3
None . . . . .	421	256	302	342	697	639	416	227	3,300	7
Not elsewhere classified . . . . .	5	0	14	7	20	3	7	0	57	6
Unspecified . . . . .	56	11	11	0	7	0	0	5	90	1
Total . . . . .	6,625	3,812	3,214	3,932	5,856	4,884	2,172	3,417	33,912	4

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-19.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by hours of training received in last 2 years

Equipment operated grouping <sup>2</sup>	0	1-8	9-15	16	17-40	41-80	81-160	161+	Unspeci- fied	Total	Mean, h
Backhoe-crane-dragline-shovel . . . . .	271	96	37	260	157	68	51	23	360	1,323	33
Belt . . . . .	37	14	3	41	19	44	11	4	75	247	34
Dozer-heavy and mobile equipment . . . . .	244	95	18	106	121	75	28	7	470	1,164	27
Drill (underground)-rock bolter . . . . .	0	0	0	0	3	0	0	0	0	3	24
Drill (surface) . . . . .	10	4	0	14	9	0	5	0	11	52	30
Explosives . . . . .	0	0	0	0	0	0	0	0	3	3	NS
Front-end loader-forklift . . . . .	1,217	629	144	879	723	556	226	191	2,074	6,640	37
Grader-scraper . . . . .	67	11	12	26	45	53	0	0	187	400	26
Handtools (powered and nonpowered) . . . . .	440	198	99	417	308	223	58	89	956	2,787	45
Many equipment . . . . .	80	18	5	23	7	28	5	5	155	326	42
Miscellaneous utility equipment . . . . .	310	113	40	183	149	186	26	32	695	1,733	35
Plant equipment . . . . .	766	374	139	583	775	477	202	208	1,522	5,045	47
Pump . . . . .	53	21	21	0	5	9	5	0	101	216	13
Scale-lab equipment-controls . . . . .	142	106	32	100	112	115	25	18	336	985	35
Shuttle car-locomotive . . . . .	0	3	0	3	7	7	0	0	0	21	41
Truck (haulage) . . . . .	1,611	628	272	964	790	606	196	81	3,354	8,501	26
Truck (utility)-personnel carrier . . . . .	46	12	0	57	23	25	0	7	41	211	59
Welding machine-lathe . . . . .	157	58	7	143	95	78	28	7	235	808	26
None . . . . .	647	109	60	424	396	228	70	52	1,314	3,300	32
Not elsewhere classified . . . . .	31	0	5	9	9	0	0	3	0	57	28
Unspecified . . . . .	5	21	7	7	7	7	11	7	18	90	121
Total . . . . .	6,132	2,509	902	4,238	3,759	2,786	947	733	11,905	33,912	35

NS Not significant.

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-20.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by years of age

Equipment operated grouping <sup>2</sup>									Unspeci- fied	Total	Mean, yr
	15-20	21-23	24-26	27-29	30-34	35-39	40-49	50+			
Backhoe-crane-dragline-shovel . . . . .	11	16	83	69	144	161	319	481	40	1,323	45
Belt . . . . .	3	10	10	31	24	33	54	53	27	247	41
Dozer-heavy and mobile equipment . . . .	3	53	95	100	145	139	285	292	52	1,164	40
Drill (underground)-rock bolter . . . . .	0	0	0	0	0	0	3	0	0	3	42
Drill (surface) . . . . .	0	5	3	0	17	0	7	13	7	52	38
Explosives . . . . .	0	0	0	0	0	0	0	0	3	3	NS
Front-end loader-forklift . . . . .	128	370	605	618	850	849	1,232	1,489	500	6,640	39
Grader-scraper . . . . .	0	11	43	22	74	32	111	87	21	400	41
Handtools (powered and nonpowered) . .	90	134	184	284	432	460	529	526	148	2,787	38
Many equipment . . . . .	3	4	35	21	16	51	58	105	32	326	42
Miscellaneous utility equipment . . . . .	195	277	290	160	196	129	199	183	105	1,733	32
Plant equipment . . . . .	63	293	443	499	749	630	953	1,116	298	5,045	39
Pump . . . . .	5	11	5	5	27	11	42	110	0	216	46
Scale-lab equipment-controls . . . . .	35	91	95	70	128	89	190	239	47	985	39
Shuttle car-locomotive . . . . .	0	0	3	4	0	3	3	7	0	21	41
Truck (haulage) . . . . .	123	328	739	768	1,127	1,098	1,592	1,789	937	8,501	39
Truck (utility)-personnel carrier . . . . .	0	2	9	19	29	5	87	56	3	211	44
Welding machine-lathe . . . . .	19	35	68	59	141	107	184	153	42	808	39
None . . . . .	39	82	143	170	389	523	728	1,101	126	3,300	44
Not elsewhere classified . . . . .	0	3	0	12	14	0	7	21	0	57	42
Unspecified . . . . .	3	19	28	7	14	4	0	0	14	90	26
Total . . . . .	722	1,745	2,881	2,920	4,514	4,323	6,583	7,821	2,404	33,912	39

NS Not significant.

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-21.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by sex

Equipment operated grouping <sup>2</sup>	Male		Female		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel . . . . .	1,323	4	0	0	0	0	1,323	4
Belt . . . . .	247	1	0	0	0	0	247	1
Dozer-heavy and mobile equipment . . . .	1,164	4	0	0	0	0	1,164	3
Drill (underground)-rock bolter . . . . .	3	0	0	0	0	0	3	0
Drill (surface) . . . . .	52	0	0	0	0	0	52	0
Explosives . . . . .	3	0	0	0	0	0	3	0
Front-end loader-forklift . . . . .	6,552	20	32	4	56	33	6,640	20
Grader-scraper . . . . .	400	1	0	0	0	0	400	1
Handtools (powered and nonpowered) . .	2,781	8	3	0	3	2	2,787	8
Many equipment . . . . .	326	1	0	0	0	0	326	1
Miscellaneous utility equipment . . . . .	1,672	5	51	6	11	6	1,733	5
Plant equipment . . . . .	4,985	15	28	4	32	18	5,045	15
Pump . . . . .	216	1	0	0	0	0	216	1
Scale-lab equipment-controls . . . . .	561	2	421	53	3	2	985	3
Shuttle car-locomotive . . . . .	21	0	0	0	0	0	21	0
Truck (haulage) . . . . .	8,405	26	66	8	30	17	8,501	25
Truck (utility)-personnel carrier . . . . .	208	1	3	0	0	0	211	1
Welding machine-lathe . . . . .	808	2	0	0	0	0	808	2
None . . . . .	3,082	9	181	23	38	22	3,300	10
Not elsewhere classified . . . . .	51	0	5	1	0	0	57	0
Unspecified . . . . .	90	0	0	0	0	0	90	0
Total . . . . .	32,949	100	790	100	174	100	33,912	100

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-22.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by race

Equipment operated grouping <sup>2</sup>	White		Black		Hispanic		Other		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel	1,165	4	56	3	77	3	12	3	13	2	1,323	4
Belt	143	0	42	2	48	2	7	2	7	1	247	1
Dozer-heavy and mobile equipment	917	3	38	2	108	4	56	12	44	7	1,164	3
Drill (underground)-rock bolter	3	0	0	0	0	0	0	0	0	0	3	0
Drill (surface)	28	0	0	0	21	1	0	0	3	1	52	0
Explosives	3	0	0	0	0	0	0	0	0	0	3	0
Front-end loader-forklift	5,802	20	320	18	352	14	89	19	77	12	6,640	20
Grader-scraper	343	1	0	0	40	2	3	1	14	2	400	1
Handtools (powered and nonpowered)	2,264	8	129	7	300	12	37	8	58	9	2,787	8
Many equipment	307	1	5	0	14	1	0	0	0	0	326	1
Miscellaneous utility equipment	1,109	4	154	9	376	15	51	11	44	7	1,733	5
Plant equipment	4,300	15	301	17	319	13	91	20	33	5	5,045	15
Pump	201	1	11	1	0	0	0	0	4	1	216	1
Scale-lab equipment-controls	899	3	32	2	37	1	9	2	9	1	985	3
Shuttle car-locomotive	7	0	3	0	0	0	0	0	11	2	21	0
Truck (haulage)	7,244	25	490	28	493	20	60	13	214	34	8,501	25
Truck (utility)-personnel carrier	171	1	14	1	19	1	0	0	7	1	211	1
Welding machine-lathe	641	2	32	2	103	4	23	5	9	1	808	2
None	2,999	10	93	5	114	5	18	4	76	12	3,300	10
Not elsewhere classified	45	0	3	0	9	0	0	0	0	0	57	0
Unspecified	53	0	18	1	19	1	0	0	0	0	90	0
Total	28,644	100	1,742	100	2,448	100	456	100	622	100	33,912	100

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-23.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> principal equipment operated, by education

Equipment operated grouping <sup>2</sup>	Some elementary		Some high school		High school diploma		Vocational diploma		Some college		College degree		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Backhoe-crane-dragline-shovel	206	16	212	16	705	53	49	4	103	8	0	0	47	4	1,323	4
Belt	35	14	55	22	95	38	13	5	14	6	0	0	35	14	247	1
Dozer-heavy and mobile equipment	115	10	168	14	610	52	54	5	71	6	27	2	119	10	1,164	3
Drill (underground)-rock bolter	0	0	0	0	3	100	0	0	0	0	0	0	0	0	3	0
Drill (surface)	9	17	4	7	14	26	5	10	4	7	0	0	18	33	52	0
Explosives	0	0	0	0	3	100	0	0	0	0	0	0	0	0	3	0
Front-end loader-forklift	516	8	1,161	17	3,406	51	493	7	289	4	95	1	680	10	6,640	20
Grader-scraper	28	7	104	26	189	47	9	2	3	1	0	0	67	17	400	1
Handtools (powered and nonpowered)	205	7	473	17	1,183	42	322	12	174	6	29	1	402	14	2,787	8
Many equipment	11	3	85	26	99	30	18	5	33	10	42	13	38	12	326	1
Miscellaneous utility equipment	366	21	383	22	523	30	78	4	67	4	3	0	314	18	1,733	5
Plant equipment	442	9	1,005	20	2,529	50	310	6	210	4	100	2	448	9	5,045	15
Pump	27	12	37	17	106	49	0	0	0	0	0	0	46	21	216	1
Scale-lab equipment-controls	15	2	95	10	482	49	72	7	112	11	46	5	162	16	985	3
Shuttle car-locomotive	3	16	3	16	0	0	0	0	7	33	0	0	7	34	21	0
Truck (haulage)	627	7	1,691	20	4,125	49	498	6	357	4	74	1	1,129	13	8,501	25
Truck (utility)-personnel carrier	11	5	21	10	85	40	9	4	28	13	19	9	38	18	211	1
Welding machine-lathe	79	10	116	14	282	35	105	13	104	13	26	3	96	12	808	2
None	118	4	376	11	1,284	39	136	4	616	19	417	13	353	11	3,300	10
Not elsewhere classified	0	0	24	42	26	46	0	0	7	12	0	0	0	0	57	0
Unspecified	0	0	18	20	43	48	0	0	14	15	0	0	16	17	90	0
Total	2,812	8	6,030	18	15,792	47	2,171	6	2,212	7	879	3	4,015	12	33,912	100

<sup>1</sup>Excluding job title category of office workers.<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.



Table E-24.—Sand and gravel mining 1986 workforce estimates: job, company, and mining experience, by work location

Experience, yr	Surface mine		Plant or mill		Office		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
<b>At present job:</b>								
0< to ≤1	5,051	19	1,257	21	803	18	7,111	19
1< to ≤2	2,951	11	711	12	586	13	4,249	11
2< to ≤3	2,640	10	479	8	403	9	3,521	9
3< to ≤5	3,056	11	786	13	352	8	4,194	11
5< to ≤10	4,515	17	1,117	19	805	18	6,436	17
10< to ≤20	3,845	14	862	14	740	17	5,447	15
20<	1,707	6	368	6	316	7	2,391	6
Unspecified	2,865	11	447	7	439	10	3,751	10
Total	26,631	100	6,026	100	4,443	100	37,100	100
Median . . . . . yr.	4	NAP	4	NAP	5	NAP	4	NAP
<b>At present company:</b>								
0< to ≤1	4,684	18	882	15	808	18	6,375	17
1< to ≤5	8,599	32	1,732	29	1,350	30	11,681	31
5< to ≤10	5,165	19	1,240	21	842	19	7,247	20
10< to ≤15	2,982	11	820	14	475	11	4,278	12
15< to ≤20	1,872	7	449	7	338	8	2,659	7
20< to ≤25	964	4	264	4	169	4	1,397	4
25< to ≤30	629	2	217	4	118	3	964	3
30<	725	3	245	4	117	3	1,087	3
Unspecified	1,011	4	176	3	225	5	1,412	4
Total	26,631	100	6,026	100	4,443	100	37,100	100
Median . . . . . yr.	5	NAP	7	NAP	5	NAP	5	NAP
<b>Total mining:</b>								
0< to ≤1	2,726	10	516	9	546	12	3,788	10
1< to ≤5	5,831	22	1,261	21	988	22	8,080	22
5< to ≤10	4,624	17	1,074	18	595	13	6,293	17
10< to ≤15	2,972	11	759	13	348	8	4,079	11
15< to ≤20	1,928	7	446	7	275	6	2,649	7
20< to ≤25	1,080	4	253	4	147	3	1,481	4
25< to ≤30	743	3	141	2	132	3	1,016	3
30<	887	3	192	3	120	3	1,199	3
Unspecified	5,840	22	1,386	23	1,290	29	8,515	23
Total	26,631	100	6,026	100	4,443	100	37,100	100
Median . . . . . yr.	8	NAP	8	NAP	6	NAP	7	NAP

NAP Not applicable.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-25.—Sand and gravel mining 1986 workforce estimates: training received, by work location

Job training for last 2 yr, h	Surface mine		Plant or mill		Office		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0	4,998	19	877	15	1,168	26	7,043	19
1-8	1,879	7	532	9	229	5	2,640	7
9-15	710	3	153	3	80	2	943	3
16	3,178	12	930	15	299	7	4,406	12
17-40	2,874	11	773	13	257	6	3,903	11
41-80	2,257	8	435	7	310	7	3,002	8
81-160	764	3	154	3	96	2	1,015	3
161+	482	2	223	4	114	3	819	2
Unspecified	9,490	36	1,948	32	1,889	43	13,328	36
Total	26,631	100	6,026	100	4,443	100	37,100	100
Mean training . . . . . h.	35	NAP	39	NAP	37	NAP	36	NAP

NAP Not applicable.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-26.—Sand and gravel mining 1986 workforce estimates: age distribution, by work location

Age, yr	Surface mine		Plant or mill		Office		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
15-20 .....	558	2	118	2	177	4	853	2
21-23 .....	1,371	5	293	5	253	6	1,917	5
24-26 .....	2,409	9	389	6	340	8	3,137	8
27-29 .....	2,249	8	596	10	278	6	3,122	8
30-34 .....	3,574	13	803	13	489	11	4,866	13
35-39 .....	3,302	12	853	14	646	15	4,801	13
40-49 .....	5,167	19	1,184	20	862	19	7,213	19
50+ .....	6,056	23	1,416	23	1,086	24	8,558	23
Unspecified .....	1,944	7	376	6	313	7	2,633	7
Total .....	26,631	100	6,026	100	4,443	100	37,100	100
Mean age .....	39	NAP	40	NAP	40	NAP	40	NAP

NAP Not applicable.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-27.—Sand and gravel mining 1986 workforce estimates: sex, race, and education, by work location

	Surface mine		Plant or mill		Office		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Sex:								
Male .....	26,338	99	5,883	98	1,867	42	34,088	92
Female .....	204	1	69	1	2,541	57	2,814	8
Unspecified .....	89	0	74	1	35	1	198	1
Total .....	26,631	100	6,026	100	4,443	100	37,100	100
Race:								
White .....	22,494	84	4,996	83	4,127	93	31,617	85
Black .....	1,280	5	446	7	56	1	1,783	5
Hispanic .....	1,976	7	429	7	118	3	2,523	7
Other .....	338	1	98	2	32	1	468	1
Unspecified .....	543	2	56	1	110	2	709	2
Total .....	26,631	100	6,026	100	4,443	100	37,100	100
Education level:								
Some elementary .....	2,270	9	517	9	44	1	2,831	8
Some high school .....	4,784	18	1,148	19	197	4	6,129	17
High school diploma .....	12,282	46	2,897	48	2,028	46	17,207	46
Vocational diploma .....	1,725	6	393	7	217	5	2,335	6
Some college .....	1,671	6	332	6	1,024	23	3,027	8
College degree .....	589	2	104	2	714	16	1,406	4
Unspecified .....	3,310	12	634	11	220	5	4,164	11
Total .....	26,631	100	6,026	100	4,443	100	37,100	100

NOTE —Owing to independent rounding, data may not equal to totals shown.

Table E-28.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, by hours of training received in last 2 years

Experience at present job, yr	0	1-8	9-15	16	17-40	41-80	81-160	161 +	Unspeci- fied	Total	Mean, h
0< to ≤1:											
Workers .....	1,200	808	157	525	841	420	227	159	2,288	6,625	36
pct .....	18	12	2	8	13	6	3	2	35	100	NAP
1< to ≤2:											
Workers .....	691	280	76	427	507	435	81	118	1,198	3,812	41
pct .....	18	7	2	11	13	11	2	3	31	100	NAP
2< to ≤3:											
Workers .....	652	269	90	337	386	317	142	132	889	3,214	51
pct .....	20	8	3	10	12	10	4	4	28	100	NAP
3< to ≤5:											
Workers .....	798	335	146	482	363	298	203	68	1,239	3,932	32
pct .....	20	9	4	12	9	8	5	2	32	100	NAP
5< to ≤10:											
Workers .....	1,168	272	208	1,046	681	515	162	107	1,696	5,856	29
pct .....	20	5	4	18	12	9	3	2	29	100	NAP
10< to ≤20:											
Workers .....	948	322	153	712	635	406	124	98	1,486	4,884	34
pct .....	19	7	3	15	13	8	3	2	30	100	NAP
20<:											
Workers .....	468	112	26	398	174	219	5	30	738	2,172	27
pct .....	22	5	1	18	8	10	0	1	34	100	NAP
Unspecified:											
Workers .....	207	111	46	311	173	176	3	21	2,369	3,417	33
pct .....	6	3	1	9	5	5	0	1	69	100	NAP
Total:											
Workers .....	6,132	2,509	902	4,238	3,759	2,786	947	733	11,905	33,912	35
pct .....	18	7	3	12	11	8	3	2	35	100	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-29.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, by years of age

Experience at present job, yr	15-20	21-23	24-26	27-29	30-34	35-39	40-49	50 +	Unspeci- fied	Total	Mean, yr
0< to ≤1:											
Workers .....	443	710	960	876	838	633	955	775	434	6,625	34
pct .....	7	11	14	13	13	10	14	12	7	100	NAP
1< to ≤2:											
Workers .....	144	310	449	418	687	510	600	534	160	3,812	35
pct .....	4	8	12	11	18	13	16	14	4	100	NAP
2< to ≤3:											
Workers .....	53	275	429	321	462	439	646	419	171	3,214	36
pct .....	2	9	13	10	14	14	20	13	5	100	NAP
3< to ≤5:											
Workers .....	38	192	418	471	687	679	777	580	90	3,932	37
pct .....	1	5	11	12	17	17	20	15	2	100	NAP
5< to ≤10:											
Workers .....	0	117	416	648	951	842	1,225	1,451	206	5,856	41
pct .....	0	2	7	11	16	14	21	25	4	100	NAP
10< to ≤20:											
Workers .....	0	0	0	58	553	835	1,448	1,804	186	4,884	46
pct .....	0	0	0	1	11	17	30	37	4	100	NAP
20<:											
Workers .....	0	0	0	0	0	23	442	1,686	21	2,172	55
pct .....	0	0	0	0	0	1	20	78	1	100	NAP
Unspecified											
Workers .....	44	141	208	127	336	362	490	573	1,136	3,417	40
pct .....	1	4	6	4	10	11	14	17	33	100	NAP
Total:											
Workers .....	722	1,745	2,881	2,920	4,514	4,323	6,583	7,821	2,404	33,912	39
pct .....	2	5	8	9	13	13	19	23	7	100	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.



Table E-30.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, by sex

Experience at present job, yr	Male		Female		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1 .....	6,316	19	270	34	39	22	6,625	20
1< to ≤2 .....	3,698	11	109	14	5	3	3,812	11
2< to ≤3 .....	3,122	9	87	11	5	3	3,214	9
3< to ≤5 .....	3,825	12	82	10	25	14	3,932	12
5< to ≤10 .....	5,712	17	105	13	39	22	5,856	17
10< to ≤20 .....	4,811	15	65	8	9	5	4,884	14
20< .....	2,131	6	9	1	32	18	2,172	6
Unspecified .....	3,334	10	62	8	21	12	3,417	10
Total .....	32,949	100	790	100	174	100	33,912	100
Median.....yr..	4	NAP	2	NAP	6	NAP	4	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-31.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, by race

Experience at present job, yr	White		Black		Hispanic		Other		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1 .....	5,615	20	311	18	516	21	65	14	118	19	6,625	20
1< to ≤2 .....	3,106	11	185	11	363	15	116	26	42	7	3,812	11
2< to ≤3 .....	2,650	9	169	10	296	12	73	16	26	4	3,214	9
3< to ≤5 .....	3,261	11	314	18	305	12	14	3	37	6	3,932	12
5< to ≤10 .....	4,919	17	368	21	402	16	92	20	75	12	5,856	17
10< to ≤20 .....	4,351	15	239	14	234	10	43	9	18	3	4,884	14
20< .....	1,917	7	102	6	89	4	23	5	41	7	2,172	6
Unspecified .....	2,825	10	54	3	243	10	30	7	265	43	3,417	10
Total .....	28,644	100	1,742	100	2,448	100	456	100	622	100	33,912	100
Median.....yr..	4	NAP	4	NAP	3	NAP	3	NAP	3	NAP	4	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-32.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at job, by education

Experience at present job, yr	Some elementary		Some high school		High school diploma		Vocational diploma		Some college		College degree		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1 .....	603	21	1,084	18	3,307	21	433	20	446	20	145	16	606	15	6,625	20
1< to ≤2 .....	221	8	799	13	1,840	12	263	12	237	11	67	8	386	10	3,812	11
2< to ≤3 .....	230	8	646	11	1,597	10	270	12	211	10	55	6	205	5	3,214	9
3< to ≤5 .....	312	11	787	13	2,020	13	306	14	220	10	84	10	202	5	3,932	12
5< to ≤10 .....	471	17	1,059	18	2,660	17	395	18	404	18	200	23	668	17	5,856	17
10< to ≤20 .....	535	19	935	16	2,036	13	310	14	448	20	180	20	440	11	4,884	14
20< .....	373	13	417	7	975	6	86	4	91	4	83	9	147	4	2,172	6
Unspecified .....	67	2	304	5	1,356	9	109	5	154	7	67	8	1,360	34	3,417	10
Total .....	2,812	100	6,030	100	15,792	100	2,171	100	2,212	100	879	100	4,015	100	33,912	100
Median.....yr..	6	NAP	4	NAP	4	NAP	4	NAP	5	NAP	7	NAP	5	NAP	4	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-33.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at company, by hours of training received in last 2 years

Experience at present company, yr	0	1-8	9-15	16	17-40	41-80	81-160	161+	Unspecified	Total	Mean, h
0< to ≤1:											
Workers .....	1,149	817	145	264	757	359	188	139	1,999	5,818	35
pct .....	20	14	2	5	13	6	3	2	34	100	NAP
1< to ≤5:											
Workers .....	2,089	867	270	951	1,074	989	376	273	3,809	10,698	40
pct .....	20	8	3	9	10	9	4	3	36	100	NAP
5< to ≤10:											
Workers .....	1,300	317	192	1,112	727	538	233	164	2,059	6,642	34
pct .....	20	5	3	17	11	8	4	2	31	100	NAP
10< to ≤15:											
Workers .....	619	191	164	658	467	267	70	65	1,433	3,934	32
pct .....	16	5	4	17	12	7	2	2	36	100	NAP
15< to ≤20:											
Workers .....	336	134	46	499	311	197	50	33	813	2,418	32
pct .....	14	6	2	21	13	8	2	1	34	100	NAP
20< to ≤25:											
Workers .....	118	57	18	369	174	118	19	5	402	1,281	28
pct .....	9	4	1	29	14	9	1	0	31	100	NAP
25< to ≤30:											
Workers .....	157	33	18	177	55	58	0	16	369	883	35
pct .....	18	4	2	20	6	7	0	2	42	100	NAP
30<:											
Workers .....	172	58	20	195	138	85	5	32	295	999	33
pct .....	17	6	2	19	14	9	1	3	29	100	NAP
Unspecified:											
Workers .....	191	35	30	14	56	175	5	5	726	1,238	36
pct .....	15	3	2	1	5	14	0	0	59	100	NAP
Total:											
Workers .....	6,132	2,509	902	4,238	3,759	2,786	947	733	11,905	33,912	35
pct .....	18	7	3	12	11	8	3	2	35	100	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-34.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at company, by years of age

Experience at present company, yr	15-20	21-23	24-26	27-29	30-34	35-39	40-49	50+	Unspecified	Total	Mean, yr
0< to ≤1:											
Workers .....	428	704	910	755	689	500	748	603	480	5,818	33
pct .....	7	12	16	13	12	9	13	10	8	100	NAP
1< to ≤5:											
Workers .....	256	875	1,264	1,263	1,692	1,564	1,755	1,328	701	10,698	35
pct .....	2	8	12	12	16	15	16	12	7	100	NAP
5< to ≤10:											
Workers .....	0	141	538	751	1,248	928	1,283	1,388	364	6,642	39
pct .....	0	2	8	11	19	14	19	21	5	100	NAP
10< to ≤15:											
Workers .....	0	0	0	99	663	837	1,078	1,085	172	3,934	44
pct .....	0	0	0	3	17	21	27	28	4	100	NAP
15< to ≤20:											
Workers .....	0	0	0	0	83	369	857	1,001	109	2,418	48
pct .....	0	0	0	0	3	15	35	41	5	100	NAP
20< to ≤25:											
Workers .....	0	0	0	0	0	60	546	672	4	1,281	51
pct .....	0	0	0	0	0	5	43	52	0	100	NAP
25< to ≤30:											
Workers .....	0	0	0	0	0	0	195	646	42	883	54
pct .....	0	0	0	0	0	0	22	73	5	100	NAP
30<:											
Workers .....	0	0	0	0	0	0	24	961	14	999	54
pct .....	0	0	0	0	0	0	2	96	1	100	NAP
Unspecified:											
Workers .....	37	25	169	51	139	65	97	137	517	1,238	35
pct .....	3	2	14	4	11	5	8	11	42	100	NAP
Total:											
Workers .....	722	1,745	2,881	2,920	4,514	4,323	6,583	7,821	2,404	33,912	39
pct .....	2	5	8	9	13	13	19	23	7	100	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-35.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at company, by sex

Experience at present company, yr	Male		Female		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1	5,528	17	260	33	30	17	5,818	17
1< to ≤5	10,355	31	298	38	45	26	10,698	32
5< to ≤10	6,462	20	137	17	42	24	6,642	20
10< to ≤15	3,878	12	49	6	7	4	3,934	12
15< to ≤20	2,384	7	24	3	11	6	2,418	7
20< to ≤25	1,256	4	3	0	21	12	1,281	4
25< to ≤30	864	3	9	1	11	6	883	3
30<	999	3	0	0	0	0	999	3
Unspecified	1,223	4	9	1	7	4	1,238	4
Total	32,949	100	790	100	174	100	33,912	100
Median . . . yr . .	5	NAP	3	NAP	6	NAP	5	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

Table E-36.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at company, by race

Experience at present company, yr	White		Black		Hispanic		Other		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1	4,922	17	280	16	434	18	84	18	98	16	5,818	17
1< to ≤5	8,911	31	561	32	921	38	168	37	138	22	10,698	32
5< to ≤10	5,612	20	327	19	478	20	119	26	106	17	6,642	20
10< to ≤15	3,425	12	219	13	242	10	31	7	16	3	3,934	12
15< to ≤20	2,127	7	129	7	130	5	26	6	7	1	2,418	7
20< to ≤25	1,109	4	79	5	62	3	9	2	21	3	1,281	4
25< to ≤30	795	3	28	2	33	1	9	2	18	3	883	3
30<	880	3	63	4	56	2	0	0	0	0	999	3
Unspecified	863	3	55	3	92	4	11	2	218	35	1,238	4
Total	28,644	100	1,742	100	2,448	100	456	100	622	100	33,912	100
Median . . . yr . .	6	NAP	6	NAP	4	NAP	4	NAP	4	NAP	5	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

Table E-37.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> experience at company, by education

Experience at present company, yr	Some elementary		Some high school		High school diploma		Vocational diploma		Some college		College degree		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
0< to ≤1	519	18	994	16	2,787	18	412	19	402	18	70	8	633	16	5,818	17
1< to ≤5	746	27	1,934	32	5,432	34	778	36	621	28	211	24	977	24	10,698	32
5< to ≤10	454	16	1,051	17	3,248	21	419	19	435	20	246	28	790	20	6,642	20
10< to ≤15	343	12	716	12	1,592	10	268	12	322	15	167	19	526	13	3,934	12
15< to ≤20	243	9	470	8	888	6	133	6	218	10	90	10	378	9	2,418	7
20< to ≤25	181	6	222	4	596	4	20	1	72	3	25	3	165	4	1,281	4
25< to ≤30	127	5	187	3	335	2	3	0	22	1	53	6	156	4	883	3
30<	168	6	238	4	410	3	32	1	59	3	18	2	74	2	999	3
Unspecified	30	1	219	4	506	3	106	5	62	3	0	0	316	8	1,238	4
Total	2,812	100	6,030	100	15,792	100	2,171	100	2,212	100	879	100	4,015	100	33,912	100
Median . . . yr . .	7	NAP	5	NAP	5	NAP	4	NAP	6	NAP	8	NAP	7	NAP	5	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.



Table E-38.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> age, by education

Age, yr	Some elementary		Some high school		High school diploma		Vocational diploma		Some college		College degree		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
15-20 .....	78	11	168	23	306	42	106	15	55	8	0	0	10	1	722	100
21-23 .....	121	7	325	19	857	49	172	10	128	7	21	1	121	7	1,745	100
24-26 .....	138	5	357	12	1,742	60	236	8	136	5	73	3	198	7	2,881	100
27-29 .....	121	4	544	19	1,609	55	183	6	193	7	114	4	155	5	2,920	100
30-34 .....	229	5	788	17	2,169	48	386	9	390	9	107	2	443	10	4,514	100
35-39 .....	246	6	577	13	2,031	47	295	7	448	10	194	4	532	12	4,323	100
40-49 .....	594	9	1,365	21	2,774	42	433	7	427	6	153	2	837	13	6,583	100
50+ .....	1,233	16	1,677	21	3,079	39	348	4	371	5	174	2	938	12	7,821	100
Unspecified .....	51	2	228	9	1,225	51	12	1	64	3	44	2	780	32	2,404	100
Total .....	2,812	8	6,030	18	15,792	47	2,171	6	2,212	7	879	3	4,015	12	33,912	100
Mean age...yr..	45	NAP	41	NAP	38	NAP	37	NAP	38	NAP	40	NAP	42	NAP	39	NAP

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

Table E-39.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> age, race, and education, by sex

	Male		Female		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Age, yr:								
15-20 .....	683	2	39	5	0	0	722	2
21-23 .....	1,644	5	66	8	35	20	1,745	5
24-26 .....	2,771	8	104	13	5	3	2,881	8
27-29 .....	2,836	9	84	11	0	0	2,920	9
30-34 .....	4,389	13	118	15	7	4	4,514	13
35-39 .....	4,181	13	100	13	42	24	4,323	13
40-49 .....	6,411	19	130	16	42	24	6,583	19
50+ .....	7,679	23	121	15	21	12	7,821	23
Unspecified .....	2,356	7	28	4	21	12	2,404	7
Total .....	32,949	100	790	100	174	100	33,912	100
Mean age...yr..	40	NAP	35	NAP	39	NAP	39	NAP
Race:								
White .....	27,849	85	748	95	47	27	28,644	84
Black .....	1,689	5	11	1	42	24	1,742	5
Hispanic .....	2,432	7	12	2	3	2	2,448	7
Other .....	440	1	16	2	0	0	456	1
Unspecified .....	538	2	3	0	81	47	622	2
Total .....	32,949	100	790	100	174	100	33,912	100
Education level:								
Some elementary .....	2,800	8	0	0	12	7	2,812	8
Some high school .....	5,930	18	95	12	5	3	6,030	18
High school diploma ..	15,311	46	419	53	63	36	15,792	47
Vocational diploma ..	2,109	6	46	6	16	9	2,171	6
Some college .....	2,058	6	148	19	7	4	2,212	7
College degree .....	855	3	14	2	11	6	879	3
Unspecified .....	3,887	12	68	9	60	34	4,015	12
Total .....	32,949	100	790	100	174	100	33,912	100

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

Table E-40.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> age and education, by race

	White		Black		Hispanic		Other		Unspecified		Total	
	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct	Workers	pct
Age, yr:												
15-20.....	667	2	19	1	32	1	3	1	0	0	722	2
21-23.....	1,416	5	53	3	217	9	12	3	47	8	1,745	5
24-26.....	2,421	8	146	8	243	10	31	7	39	6	2,881	8
27-29.....	2,378	8	144	8	333	14	32	7	33	5	2,920	9
30-34.....	3,750	13	237	14	412	17	65	14	50	8	4,514	13
35-39.....	3,645	13	276	16	317	13	59	13	27	4	4,323	13
40-49.....	5,598	20	446	26	350	14	108	24	82	13	6,583	19
50+.....	6,810	24	396	23	424	17	122	27	69	11	7,821	23
Unspecified.....	1,959	7	27	2	120	5	23	5	276	44	2,404	7
Total.....	28,644	100	1,742	100	2,448	100	456	100	622	100	33,912	100
Mean age.....yr..	40	NAP	40	NAP	36	NAP	41	NAP	37	NAP	39	NAP
Education level:												
Some elementary.....	1,759	6	419	24	586	24	47	10	0	0	2,812	8
Some high school.....	4,847	17	494	28	601	25	56	12	33	5	6,030	18
High school diploma..	14,255	50	592	34	632	26	250	55	63	10	15,792	47
Vocational diploma...	1,966	7	88	5	50	2	35	8	32	5	2,171	6
Some college.....	2,026	7	44	3	120	5	19	4	3	1	2,212	7
College degree.....	839	3	18	1	0	0	7	2	16	3	879	3
Unspecified.....	2,951	10	87	5	459	19	42	9	475	76	4,015	12
Total.....	28,644	100	1,742	100	2,448	100	456	100	622	100	33,912	100

NAP Not applicable.

<sup>1</sup>Excluding job title category of office workers.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-41.—Sand and gravel mining 1986 workforce estimates: number of workers and coefficient of variation, by employment size class

Employment size class <sup>1</sup>	Workers	CV, pct
1-19.....	25,200	3.3
20-49.....	9,117	14.1
50-99.....	2,444	9.7
100-249.....	339	5.7
All groupings.....	37,100	3.0

<sup>1</sup>MSHA size groups are based on the annual average employment of the primary subunit and not on the total employment; hence, MSHA published injury statistics by size groups should not be analyzed against these data.

NOTE—Owing to independent rounding, data may not add to totals shown.

Table E-42.—Sand and gravel mining 1986 workforce estimates: number of workers and coefficient of variation, by job title

Job title grouping <sup>1</sup>	Workers	CV, pct
Backhoe-crane-dragline-shovel operator....	1,279	13.1
Beltman-belt repairman.....	208	20.8
Blaster.....	3	100.0
Deckhand-barge and dredge operator.....	853	7.5
Dozer-heavy and mobile equipment operator	1,381	13.4
Driller-rock bolter.....	56	33.2
Electrician-lampman.....	75	21.0
Front-end loader-forklift operator.....	5,933	4.7
Grader-scraper operator.....	352	30.5
Laborer-miner-utility man.....	2,918	5.7
Manager-foreman-supervisor:		
General.....	3,466	2.6
Maintenance.....	40	17.3
Working.....	387	15.7
Mechanic-welder-oiler-machinist.....	3,299	4.4
Mine technical support.....	1,439	13.4
Office worker.....	3,188	8.9
Plant operator-warehouseman.....	3,918	2.5
Shuttle car-tram operator.....	32	42.7
Truck driver.....	8,274	9.5
All groupings.....	37,100	3.0

<sup>1</sup>As defined by MSHA; see appendix A for detailed explanation of job title grouping.

NOTE—Owing to independent rounding, data may not add to totals shown.

**Table E-43.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> number of workers and coefficient of variation, by principal equipment operated**

Equipment operated grouping <sup>2</sup>	Workers	CV, pct
Backhoe-crane-dragline-shovel .....	1,323	10.8
Belt .....	247	24.9
Dozer-heavy and mobile equipment .....	1,164	8.1
Drill (underground)-rock bolter .....	3	100.0
Drill (surface) .....	52	37.4
Explosives .....	3	100.0
Front-end loader-forklift .....	6,640	4.9
Grader-scraper .....	400	25.7
Handtools (powered and nonpowered) .....	2,787	4.9
Many equipment .....	326	20.9
Miscellaneous utility equipment .....	1,733	9.6
Plant equipment .....	5,045	3.7
Pump .....	216	18.0
Scale-lab equipment-controls .....	985	18.0
Shuttle car-locomotive .....	21	48.8
Truck (haulage) .....	8,501	9.0
Truck (utility)-personnel carrier .....	211	13.5
Welding machine-lathe .....	808	11.3
None .....	3,300	3.7
Not elsewhere classified .....	57	58.1
Unspecified .....	90	27.1
All groupings .....	33,912	2.6

<sup>1</sup>Excluding job title category of office workers.

<sup>2</sup>See appendix B for detailed explanation of equipment operated grouping.

NOTE —Owing to independent rounding, data may not add to totals shown.

**Table E-44.—Sand and gravel mining 1986 workforce estimates: number of workers and coefficient of variation, by work location**

Work location	Workers	CV, pct
Surface mine .....	26,631	2.7
Plant or mill .....	6,026	8.3
Office .....	4,443	8.5
All groupings .....	37,100	3.0

NOTE —Owing to independent rounding, data may not add to totals shown.

**Table E-45.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> number of workers and coefficient of variation, by experience at job, company, and mining**

Experience, yr	Workers	CV, pct
At present job:		
0< to ≤1 .....	6,625	5.9
1< to ≤2 .....	3,812	5.1
2< to ≤3 .....	3,214	4.3
3< to ≤5 .....	3,932	2.4
5< to ≤10 .....	5,856	7.0
10< to ≤20 .....	4,884	4.8
20< .....	2,172	5.3
Unspecified .....	3,417	15.8
All groupings .....	33,912	2.6
At present company:		
0< to ≤1 .....	5,818	5.1
1< to ≤5 .....	10,698	4.9
5< to ≤10 .....	6,642	5.4
10< to ≤15 .....	3,934	4.0
15< to ≤20 .....	2,418	8.8
20< to ≤25 .....	1,281	10.6
25< to ≤30 .....	883	11.1
30< .....	999	17.0
Unspecified .....	1,238	20.9
All groupings .....	33,912	2.6

Total mining:

0< to ≤1 .....	3,439	6.6
1< to ≤5 .....	7,375	3.6
5< to ≤10 .....	5,852	6.4
10< to ≤15 .....	3,835	4.0
15< to ≤20 .....	2,466	8.3
20< to ≤25 .....	1,361	11.5
25< to ≤30 .....	912	6.3
30< .....	1,114	13.8
Unspecified .....	7,558	11.8
All groupings .....	33,912	2.6

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

**Table E-46.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> number of workers and coefficient of variation, by training received**

Job training for last 2 yr, h	Workers	CV, pct
0 .....	6,132	9.0
1-8 .....	2,509	11.7
9-15 .....	902	13.0
16 .....	4,238	8.9
17-40 .....	3,759	13.5
41-80 .....	2,786	8.1
81-160 .....	947	9.6
161+ .....	733	5.8
Unspecified .....	11,905	7.8
All groupings .....	33,912	2.6

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.



**Table E-47.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> number of workers and coefficient of variation, by age**

Age, yr	Workers	CV, pct
15-20 .....	722	12.3
21-23 .....	1,745	10.9
24-26 .....	2,881	7.0
27-29 .....	2,920	7.2
30-34 .....	4,514	4.4
35-39 .....	4,323	2.4
40-49 .....	6,583	4.8
50+ .....	7,821	4.7
Unspecified .....	2,404	16.2
All groupings .....	33,912	2.6

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

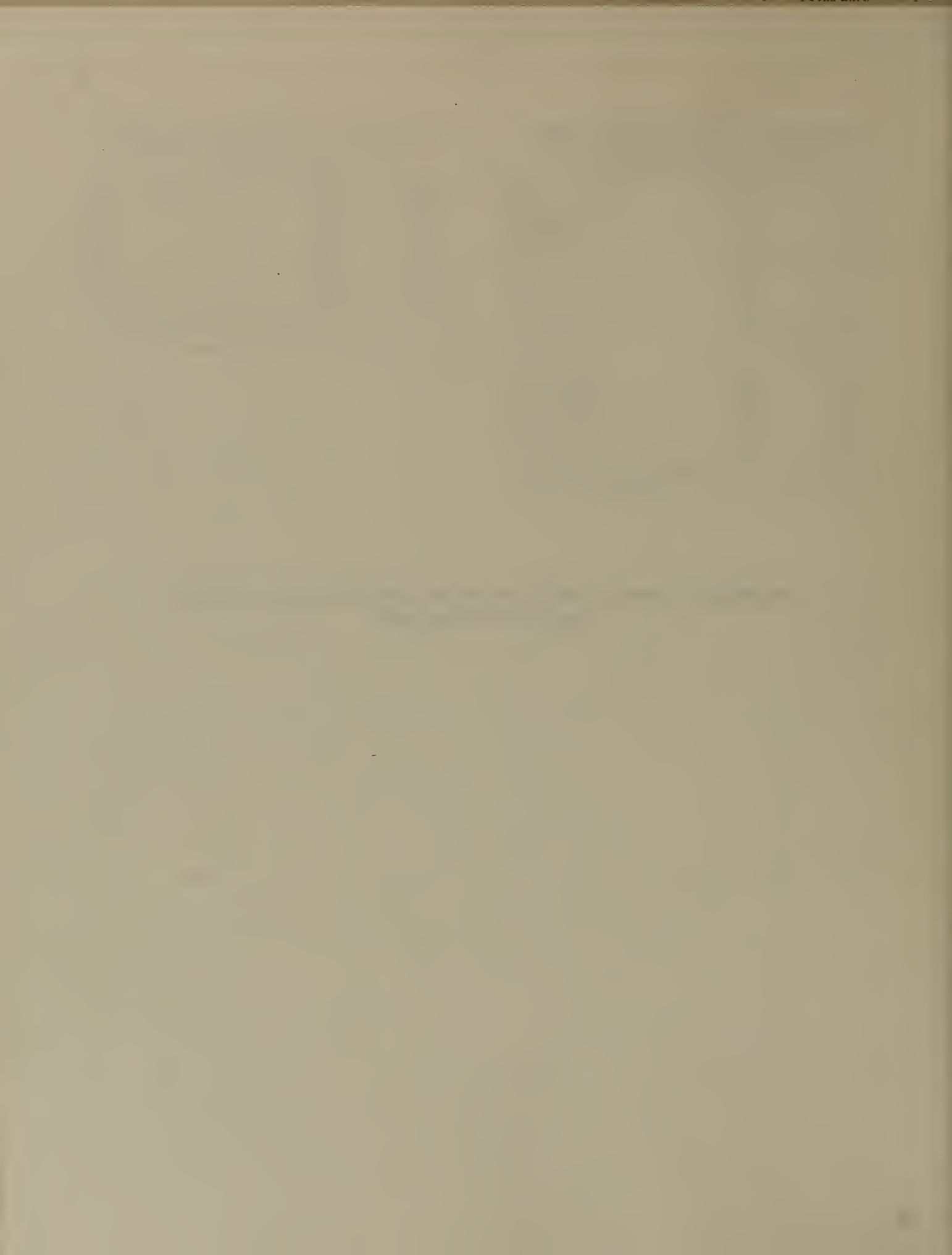
**Table E-48.—Sand and gravel mining 1986 workforce estimates:<sup>1</sup> number of workers and coefficient of variation, by sex, race, and education**

	Workers	CV, pct
Sex:		
Male .....	32,949	2.6
Female .....	790	13.2
Unspecified .....	174	32.2
All groupings .....	33,912	2.6
Race:		
White .....	28,644	2.8
Black .....	1,742	9.0
Hispanic .....	2,448	8.7
Other .....	456	12.4
Unspecified .....	622	33.2
All groupings .....	33,912	2.6
Education level:		
Some elementary .....	2,812	11.1
Some high school .....	6,030	6.9
High school diploma .....	15,792	4.4
Vocational diploma .....	2,171	12.8
Some college .....	2,212	6.1
College degree .....	879	11.2
Unspecified .....	4,015	10.8
All groupings .....	33,912	2.6

<sup>1</sup>Excluding job title category of office workers.

NOTE —Owing to independent rounding, data may not add to totals shown.

**APPENDIX F.—MINING INDUSTRY POPULATION SURVEY LETTERS  
AND QUESTIONNAIRE**







## United States Department of the Interior

BUREAU OF MINES  
2401 E STREET, NW.  
WASHINGTON, D.C. 20241

Dear Mine Manager:

The Bureau of Mines, U.S. Department of the Interior, is requesting your help in conducting a survey of the mining industry. The survey is designed to characterize the nation's mine-worker population by occupation, job experience, training, age, and other factors. These data are necessary to accurately analyze the nation's mine accidents. At this time, the information sought by this survey cannot be obtained from any other source.

Your firm was randomly selected to represent firms of a similar size in your industry. Although your response to this survey is voluntary, the validity of the results depends upon a very high response rate. We urge you, therefore, to respond as completely and accurately as possible based upon information from your personnel files, management records, or direct response from individual workers at your mine.

Under no circumstances will the information you provide be identified by individual mine, company, or worker. The data will be used for statistical purposes only and the results of the survey when analyzed with accident statistics will be made available to the public in the form of official publications.

Instructions for completing the survey questionnaire are on the enclosed survey form. Questions regarding the survey should be directed to:

Ms. Shail Butani  
Bureau of Mines  
5629 Minnehaha Avenue South  
Minneapolis, MN 55417  
Telephone: (612) 725-4500

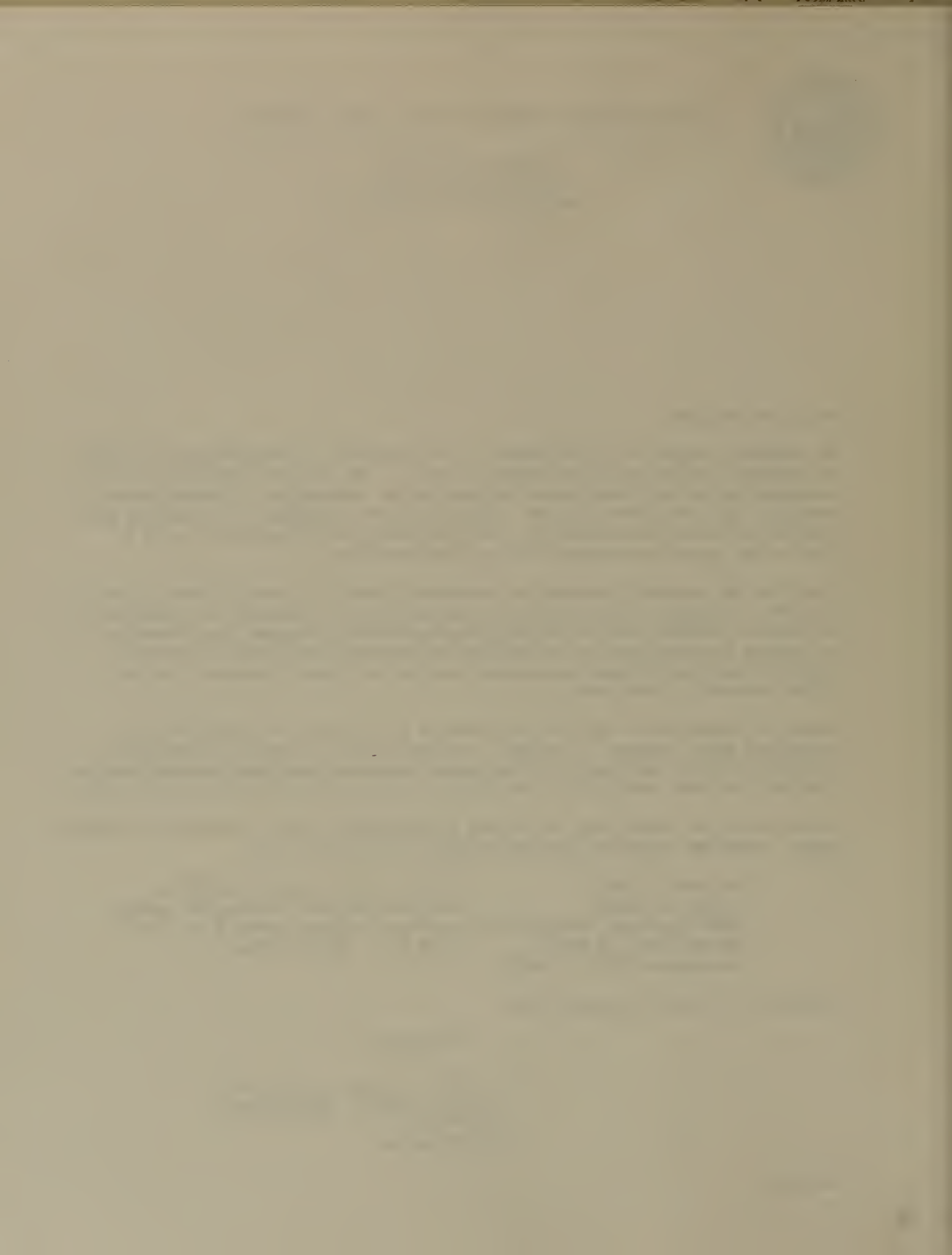
(Note: Collect calls regarding this survey will be accepted during regular business hours, 8:00 a.m. to 4:00 p.m., Central Time.)

Thank you for your time and effort.

Sincerely,

*Robert C. Horton*  
Director

Enclosure





# United States Department of the Interior

BUREAU OF MINES  
2401 E STREET, NW.  
WASHINGTON, D.C. 20241

Dear Employer:

Recently, we wrote to you requesting your help in obtaining data for a survey for the mining industry. This information will be used to produce the characteristics of the nation's mine-worker population in order to analyze the nation's mine accident data more accurately. We have not yet received your response and have enclosed an additional survey questionnaire in case the original was misplaced or did not reach you.

Because your firm was randomly selected to represent firms of a similar size in your industry, we are making every effort to obtain your response to ensure a true representation of those firms. Your response is strictly confidential and will be used for statistical purposes only.

If you have any questions, please refer to the instructions on the first page of the questionnaire or call collect, Ms. Shail Butani at 612-725-4500. If you prefer, you may report your information directly by telephone. A response during the next 2 weeks would be great assistance to the survey.

Thank you for your help and support in the Bureau's effort to characterize the mine-worker population.

Sincerely,

*Robert C. Horton*  
Director

Enclosure





THE JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION  
PUBLISHED WEEKLY  
CHICAGO, ILL., MAY 1, 1919  
Vol. 34, No. 19

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U.S. BUREAU OF MINES  
Twin Cities Research Center  
5629 Minnehaha Avenue South  
Minneapolis, MN 55417  
(612) 725-4500

## MINING INDUSTRY POPULATION SURVEY

### INSTRUCTIONS:

1. Fill out this form as completely as possible and return it in the enclosed stamped envelope within three weeks.
2. This form is only for the operation with mine I.D. number as shown on the address label. Do not use for any other operation.
3. As an alternative to completing the forms, you are welcome to send copies of any administrative records, containing the requested information on *all* employees. However, it is very important that all the information requested on the forms be contained in the records.
4. (a) Obtain a list or lists of *all* the employees (hourly, salaried, managerial, and office workers, etc.) working in the operation with mine I.D. number shown on the label. It is important that each employee appear on one and only one list.  
(b) Sequentially number the employees starting with one list continuing until all the lists are exhausted.  
(c) Determine the total number of employees at this mine I.D. operation. Note: This number should be the same as the last number on the employees list.  
(d) Based on the total number of employees, mark the appropriate employment size box below.

Total No. of Employees	Selection Numbers
1 - 49 <input type="checkbox"/>	All employees (1, 2, 3, 4, 5 ...)
50 - 99 <input type="checkbox"/>	Every other employee starting with employee No. 1 (1, 3, 5, 7, 9 ...)
100 - 249 <input type="checkbox"/>	Every 5th employee starting with employee No. 4 (4, 9, 14, 19, 24 ...)
250 - 499 <input type="checkbox"/>	Every 10th employee starting with employee No. 7 (7, 17, 27, 37, 47 ...)
500 - 999 <input type="checkbox"/>	Every 20th employee starting with employee No. 12 (12, 32, 52, 72, 92 ...)
1,000 + <input type="checkbox"/>	Every 30th employee starting with employee No. 15 (15, 45, 75, 105, 135 ...)

- (e) Record the information on the attached questionnaire for each worker whose number on the employee list corresponds to the selection numbers that fall in the above marked employment size category. Note: Depending on the total number of employees at this mine, it may not be necessary to complete all lines on the questionnaire.  
(f) See Example below.
5. If you should have any questions or need assistance in completing the form please contact \_\_\_\_\_
6. Company representative to be contacted regarding this report: \_\_\_\_\_

Name \_\_\_\_\_ Title \_\_\_\_\_ Phone ( ) \_\_\_\_\_

### EXAMPLE:

Suppose there are 153 hourly employees, 31 salaried employees, and 9 office employees at Mine Operation XYZ.

Procedure: 1. Number the workers on one list first, say office (1-9).

2. Continuously number the workers on the 2nd list, say salaried (10-40).

3. Continuously number the workers on the next list, hourly (41-193).

4. Total number of employees at Mine ID XYZ is 193. Hence, check the box inside 100-249 employees.

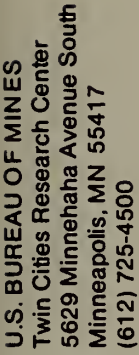
5. Record information for employees whose numbers are 4, 9, 14, 19, 24, 29, 34 ... 179, 184, 189.

Note: In this case, a total of 38 employees are in the sample.

MS. SHAIL BUTANI  
U.S. Bureau of Mines  
Twin Cities Research Center  
5629 Minnehaha Avenue South  
Minneapolis, MN 55417  
CALL COLLECT (612) 725-4500



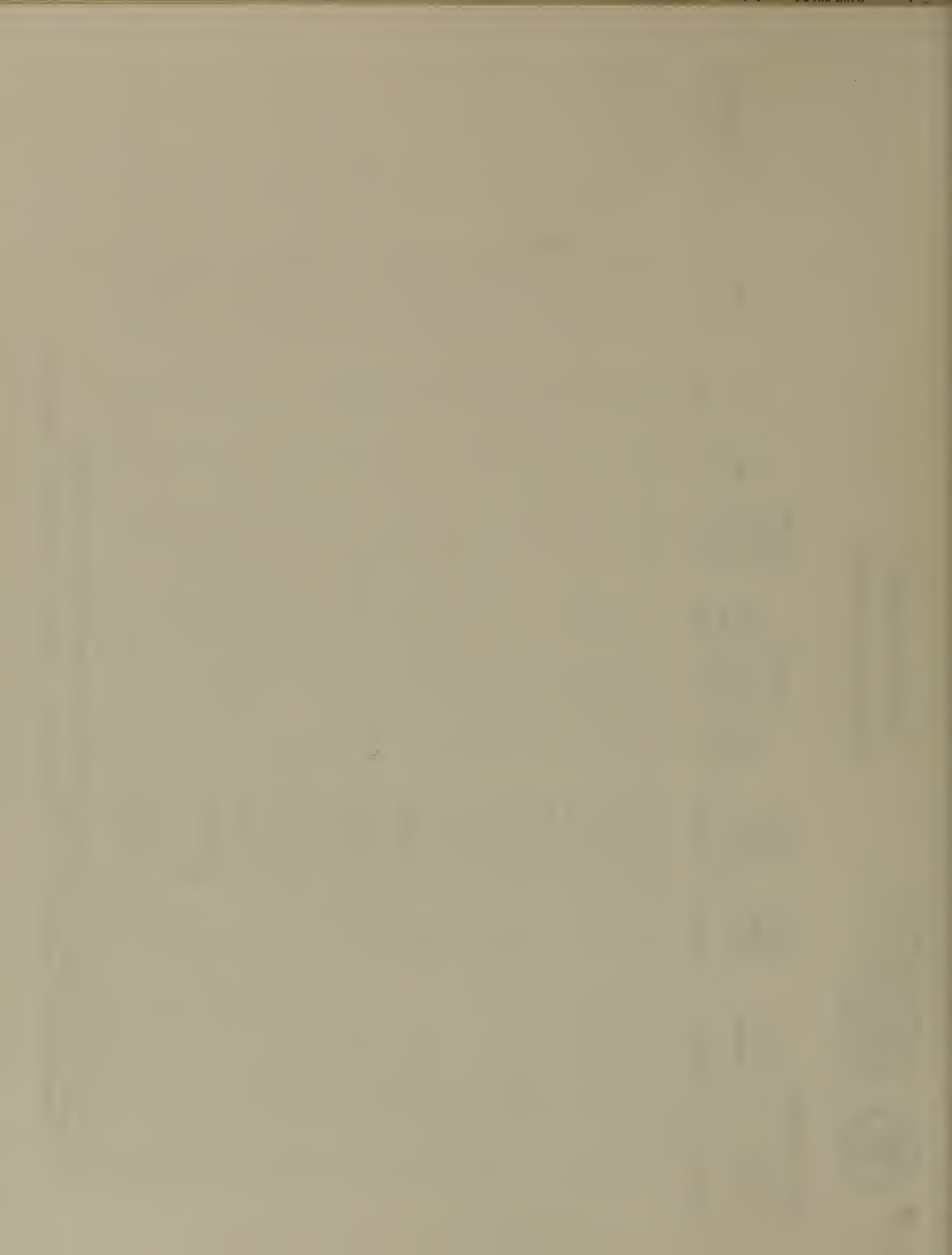




## EMPLOYEE DATA:

[illegible]

<sup>3</sup> E – 1 through 8th grade; SH – some high school; HD – high school diploma; V – vocational; SC – some college; CD – college degree





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## MINING INDUSTRY POPULATION SURVEY

### EMPLOYEE DATA:

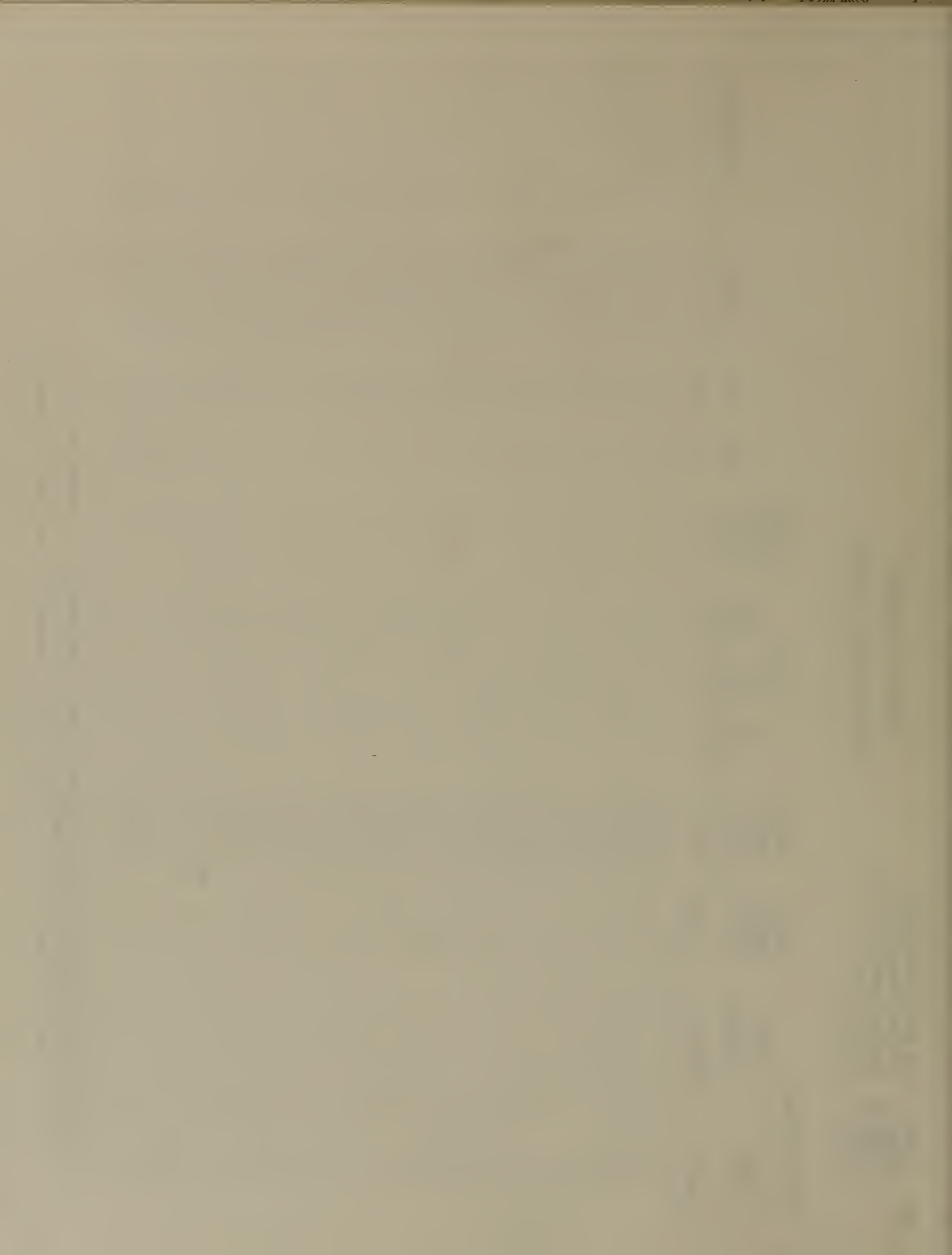
Sample No.	Job title or occupation	Principal equipment operated (if any)	Principal operation subunit code <sup>1</sup>	Experience			Job-related training during last 2 years wks/hrs	Age yrs.	Sex		Race <sup>2</sup>				Education <sup>3</sup>				
				This job yrs/mo	This co. yrs/mos	Total mine yrs/mos			M	F	W	B	H	O	U	E	SH	HD	V
EXAMPLE	truck driver	truck	U <input type="checkbox"/> SU <input type="checkbox"/> S <input type="checkbox"/> P <input type="checkbox"/> O <input type="checkbox"/>	5/3	7/0	8/6	4/10	29	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<sup>1</sup> U — underground; SU — surface operations at underground mines; S — surface; P — preparation plant or mill; O — office worker

<sup>2</sup> W — white; B — black; H — hispanic; O — other; U — unknown

<sup>3</sup> E — 1 through 8th grade; SH — some high school; HD — high school diploma; V — vocational; SC — some college; CD — college degree







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## MINING INDUSTRY POPULATION SURVEY

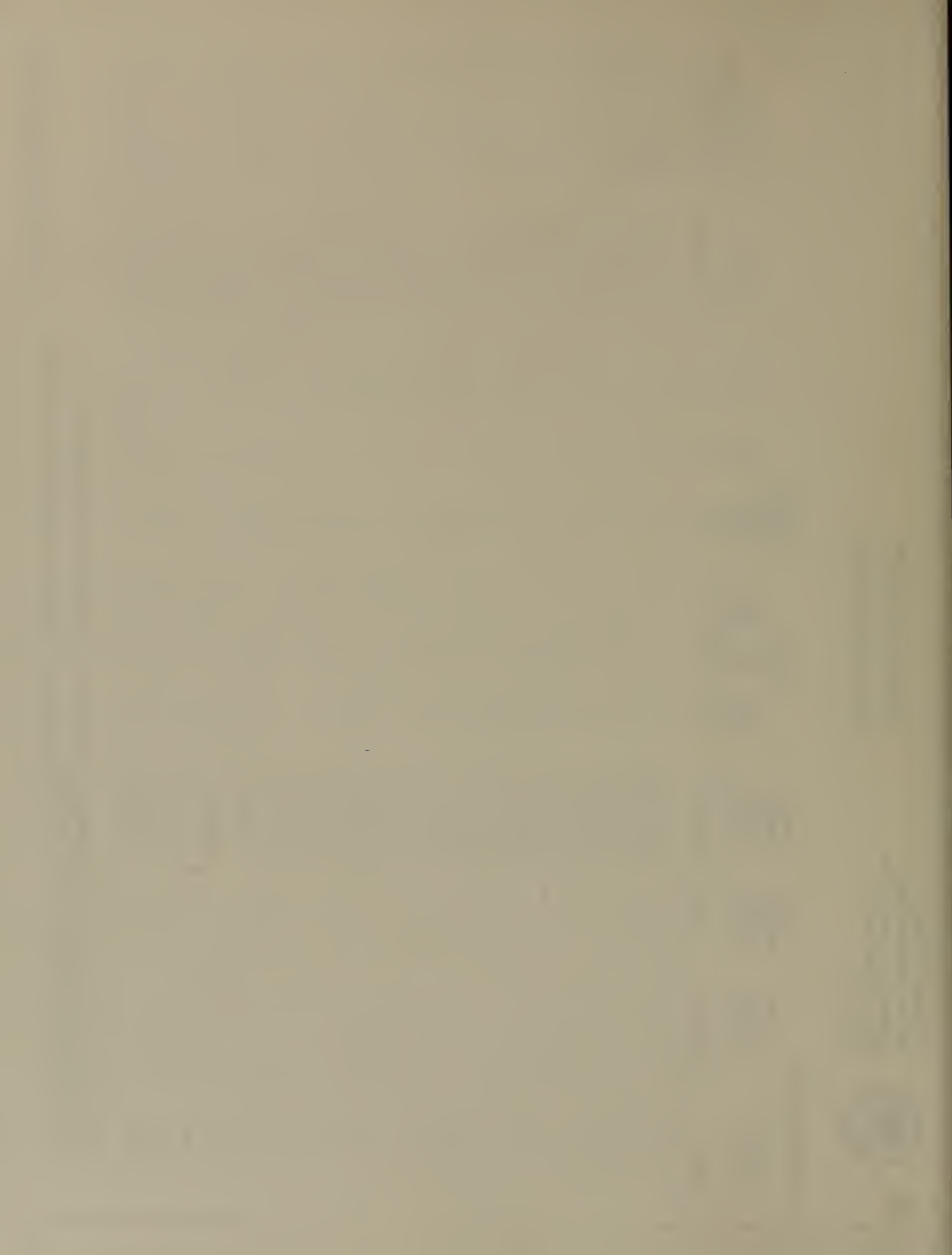
### EMPLOYEE DATA:

Sample No.	Job title or occupation	Principal equipment operated (if any)	Principal operation subunit code <sup>1</sup>	Experience			Job-related training during last 2 years	Age yrs.	Sex		Race <sup>2</sup>				Education <sup>3</sup>				
				This job yrs/mo	This co. yrs/mo	Total mine yrs/mo			M	F	W	B	H	O	U	E	SH	HD	V
EXAMPLE	truck driver	truck	U <input type="checkbox"/> SU <input type="checkbox"/> S <input type="checkbox"/> P <input type="checkbox"/> O <input type="checkbox"/>	5/3	7/0	8/6	4/10	29	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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<sup>2</sup> W — white; B — black; H — hispanic; O — other; U — unknown

<sup>3</sup> E — 1 through 8th grade; SH — some high school; HD — high school diploma; V — vocational; SC — some college; CD — college degree











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